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A study of differences between health professionals and lay people

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Assessment of healthy diets and physical activity

A study of differences between health professionals and lay people

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Table of content

Preface

This thesis is based on work carried out at the National Food Institute, Technical University of Denmark in Division of Risk Assessment and Nutrition (until the beginning of 2015, Division of Nutrition), from October 2012 to October 2016.

My interest in the topic of this thesis – differences between assessments of healthy diets and physical activity by health professionals and lay people – developed throughout my work as a research assistant in Division of Nutrition. The research and advisory activities among my colleagues were based primarily on the background of nutrition and food-related sciences. With a background in sociology and experiences with qualitative research methods, and with mixing quantitative and qualitative research methods, I saw a research potential in including these perspectives in the work being carried out, hopefully enriching the perspectives of the current research.

After finishing this thesis, there are some post reflections with regard to mixing different methods as well as different disciplines, I would like to share with the reader. I have indeed experienced several advantages in applying a mixed method design, such as obtaining a more complete picture of the phenomenon of interest (Bryman, 2006; Greene et al., 1989; Johnson et al., 2007; Mason, 2006; Padgett, 2012). However, mixed method designs also involve a number of challenges (Bryman, 2007); among other things related to publishing and having sufficient expertise in both methods. Before starting this thesis, I was mostly focused on the advantages of studying a topic in depth as well as in width. However, I have realized that the challenges should be carefully considered before choosing a mixed method design. Because of the challenges of publishing mixed methods studies, each study was designed as either quantitative or qualitative. The idea was to combine the studies in the writing of the thesis. However, during the process of publishing I realized that it was more difficult to argue for the innovatory elements of each study when separated from the others. With regard to the challenges of mastering two different research methods, I believed it would be possible within a range of three years of a thesis, but I have realized that it may have affected the thoroughness of each of the methods.

Being educated as a sociologist and working with public health and nutritionist for five years before starting my PhD, makes my professional identity interdisciplinary. Therefore, the mix of these disciplines was a natural choice for this thesis. Accordingly, two of my supervisors had a background in public health nutrition and one in sociology. There are certainly many advantages by doing interdisciplinary research. Foremost, the topic of interest is viewed from different perspectives and each discipline has a chance to widen its perspectives accordingly. However,

it has also become very clear during my thesis that interdisciplinary research includes some challenges. As scientific journals are often either one discipline or another, I had to make several compromises with my sociological background when preparing a paper for a public health journal. I have also realized the challenges in the professional discussions among different disciplines, and I know now that interdisciplinarity takes time; however it is possible to reach a common understanding.

The thesis is based on the totality of the research conducted in connection with the three papers included in the thesis. The objectives of the papers are therefore not fully identical with the specific objectives of the thesis.

In the thesis I used data from the Danish National Survey of Diet and Physical Activity 2011-2013. During my time as a research assistant, I contributed to the process of preparing the survey, cleaning and processing the data.

Mette Rosenlund Sørensen, October 2016

Acknowledgements

Throughout the process of accomplishing this thesis I have received guidance, inspiration, critique and support from a number of people to whom I would like to express my deepest gratitude.

I am sincerely grateful to all my supervisors for their professional and constructive guidance. Inge Tetens, a special thanks to you for your encouragements and support, especially in the moments where I needed it the most. Jeppe Matthiessen, I would like to thank you for your thoroughness and for always having five minutes for discussing and answering my questions. Lotte Holm, I am grateful for your guidance, your feedback always inspired me and encouraged me to go forward. Elisabeth Wreford Anderson, thank you for guiding me through the statistical analyses and commenting the reporting of the results. I would also like to express a special and warm thanks to Margit Velsing Groth, who guided me in her last year at the National Food Institute and in the first year of my PhD. You have been a great source of inspiration and support throughout my work life at the National Food Institute.

I would also like to express my gratitude to the research team behind the Danish National Survey of Diet and Physical Activity. I appreciate our teamwork and I am very thankful for your help and support throughout my PhD.

I am also thankful to the participants of the consecutive PhD course The Sociology of Food and Agriculture at the University of Copenhagen. Our meetings have been a great inspiration and an important balance from the sociological field. A special thanks to Katherine O'Doherty Jensen for reviewing the language of paper III.

A deep gratitude also goes to my family and friends. Thanks for your support, for listening to my frustrations and for all the good moments.

Heitor, I want to thank you, from the bottom of my heart, for your love, your endless support and the way you always make me smile. I could not have done this without you.

Lastly, I would like to express my gratitude to the National Food Institute, Technical University of Denmark and to the DTU (for a partial PhD scholarship) which made it possible for me to pursue my ambitions in relation to this thesis.

List of papers

This thesis includes the following papers:

I: Mette Rosenlund Sørensen, Inge Tetens, Elisabeth Wreford Andersen, Jeppe Matthiessen. Optimistic and pessimistic self-assessment of physical activity is associated with gender and self-rated health in Danish adults

II: Mette Rosenlund Sørensen, Jeppe Matthiessen, Lotte Holm, Vibeke Kildegaard Knudsen, Elisabeth Wreford Andersen, Inge Tetens. Optimistic and pessimistic self-assessment of own diets is associated with age, self-rated health and weight status in Danish adults. Submitted to Appetite

III: Mette Rosenlund Sørensen & Lotte Holm (2016). ”I feel food and I am not overweight” – A qualitative study of considerations underlying lay people’s self-assessments of unhealthy diets. *Appetite 107, 135-143*

Summary

Background: Food and health authorities provide evidence-based guidelines on healthy diets and physical activity with the aim to promote good health for the general population. However, according to surveillance data, substantial proportions of populations do not comply with these guidelines. Concurrently, several studies suggest that considerable proportions of different populations assess the healthiness of their diets and physical activity level far more optimistically than assessments based on scientific evidence and standardised methods indicate. This optimistic self-assessment is highlighted as a potential barrier in the promotion of healthier diets and physical activity. Studies also suggest that some people are pessimistic about the healthiness of their diets and physical activity level. Both optimistic and pessimistic self-assessments indicate important differences between assessments of healthy diets and physical activity by health professionals and lay people. More knowledge about what is behind such differences is needed.

Aim and objectives: The overall aim of this thesis was to examine differences between assessments of healthy diets and physical activity by health professionals and lay people and to explore what might be behind such differences. The specific research objectives were:

- To examine the extent to which Danish adults assess the healthiness of their diets and physical activity more optimistically and pessimistically than assessed by health professionals
- To examine if optimistic and pessimistic self-assessments of diet healthiness and physical activity are associated with socio-demography, health and health behaviours
- To explore considerations underlying lay people's self-assessments of unhealthy diets

Methods: A mixed method approach was applied. The extent of optimistic and pessimistic assessors was examined with descriptive analyses and associated factors were examined with multiple logistic regression models. Considerations underlying lay people's self-assessments were explored with thematic analysis of qualitative individual interviews. Data were derived from the Danish National Survey of Diet and Physical Activity (DANSDA). Analyses of physical activity included data from DANSDA 2011-2012, while analyses of diet included data from DANSDA 2011-2013. The 16 interviewees included in the qualitative study were recruited from participants in DANSDA 2011-2013. Optimistic and pessimistic self-assessment of diet healthiness and physical activity was defined by comparing participants' actual behaviour with their self-assessed behaviour. Information on actual diets was derived from seven days pre-coded food diaries, and diet quality was evaluated by means of a diet index. Information on actual physical activity was derived from seven days pedometer-determined step counts.

Information about self-assessed diet healthiness and physical activity was obtained through two questions in a structured face-to-face interview. Optimistic self-assessment of physical activity was defined as taking less than 8,000 steps/day (inactive) and assessing own activity level as moderate or vigorous, and pessimistic self-assessment was defined as taking at least 10,000 steps/day (active) and assessing own activity level as light or sedentary. Optimistic self-assessment of diet healthiness was defined as a diet index score in the lowest tertile of the diet index (unhealthy diets) and assessing own diets to be healthy enough. Pessimistic self-assessment was defined as a diet index score in the highest tertile (healthy diets) and assessing own diets not to be healthy enough. In the qualitative study, all interviewees had unhealthy diets. Half of them were optimistic about the healthiness, while the other half were realistic about the healthiness.

Results: In DANSDA 2011-2012, 1418 adults provided valid step data. Among inactive adults (39 %), 27 % were optimistic assessors, while 73 % were realistic assessors. Among active adults (41 %), 50 % were pessimistic assessors, while 50 % were realistic assessors. In DANSDA 2011-2013, valid dietary intake data were available from 3014 adults. Among adults with unhealthy diets (40 %), 55 % were optimistic assessors, while 45 % were realistic assessors. Among adults with healthy diets (28 %), 65 % were pessimistic assessors, while 35 % were realistic assessors. Optimistic and pessimistic self-assessments of diet healthiness and physical activity were associated with different health characteristics such as self-rated health and weight status. Favourable health characteristics, such as excellent self-rated health and normal weight, were associated with optimistic self-assessment, while less favourable health characteristics, such as good self-rated health and obesity, were associated with pessimistic self-assessment. Furthermore, men were more likely to be optimistic about their physical activity level, while women were more likely to be pessimistic. Finally, older adults were more likely to be optimistic about the healthiness of their diets, while younger adults were more likely to be pessimistic. When interviewees in the qualitative study were asked to assess the healthiness of their diets, they typically referred to healthy and unhealthy foods and eating practices. They also assessed the healthiness with reference to different guidelines. However, while drawing on their knowledge and perceptions about healthy eating, at the end, this was overruled by more decisive criteria. Thus, diets might be assessed as not exactly healthy, but nevertheless as healthy enough – if interviewees felt good. Furthermore, weight status and weight concerns were found to be decisive criteria in interviewees' self-assessments. Optimistic self-assessment seemed to emerge from perceiving oneself as normal weight, not having experiences with weight loss or weight gain or not being concerned about personal weight status.

Conclusion: The findings of this thesis suggest that a considerable proportion of Danish adults assess the healthiness of their diets and physical activity level differently than assessed by health professionals. Furthermore, the findings indicate that favourable health characteristics are associated with optimistic self-assessment, while less favourable health characteristics are associated with pessimistic self-assessment. The findings of the qualitative study suggest that feeling healthy and being normal weight function as signs of healthy dietary habits, while overweight and weight concerns seem to support a more realistic self-assessment of unhealthy dietary habits.

Overview of research objectives, methods and main findings

Objectives	Papers	Study population and methods	Main findings
I: To examine the extent to which Danish adults assess the healthiness of their diets and physical activity more optimistically and pessimistically than assessed by health professionals	I	DANSDA 2011-2012, 18-75 y, N=1418 Cross-sectional, pedometer data, self-assessed physical activity level	Among inactive adults (39 %), 27 % assessed their activity level optimistically. Among active adults (41 %), 50 % assessed their activity level pessimistically. Among adults with unhealthy diets (40 %), 55 % assessed the healthiness optimistically. Among adults with healthy diets (28 %), 65 % assessed the healthiness pessimistically.
	II	DANSDA 2011-2013,18-75 y, N=3014 Cross-sectional, pre-coded food diaries, diet quality index, self-assessed diet healthiness	
II: To examine if optimistic and pessimistic self-assessments of diet healthiness and physical activity are associated with socio-demography, health and health behaviours	I	DANSDA 2011-2012, 18-75 y, N=1418 Cross-sectional, pedometer data, self-assessed physical activity level	Favourable health characteristics were associated with optimistic self-assessments, while less favourable health characteristics were associated with pessimistic self-assessments. Men were more likely to be optimistic about their physical activity level, while women were more likely to be pessimistic. Older adults were more likely to be optimistic about the healthiness of their diets, while younger adults were more likely to be pessimistic.
	II	DANSDA 2011-2013,18-75 y, N=3014 Cross-sectional, pre-coded food diaries, diet quality index, self-assessed diet healthiness	
III: To explore considerations underlying lay people's self-assessments of unhealthy diets	III	Interviewees recruited among participants in DANSDA 2011-2013, 28-61 y, N=16 Qualitative individual interviews	Knowledge and perceptions about healthy eating were part of interviewees' considerations. Weight status and weight concerns, wellbeing and a bodily feeling were found be decisive criteria in interviewees' self-assessments. Feeling healthy and being normal weight seemed to function as signs of healthy dietary habits, while overweight and weight concerns seemed to support a more realistic self-assessment of unhealthy dietary habits.

Resumé (Danish summary)

Baggrund: Fødevare- og sundhedsmyndigheder sammenfatter den videnskabelige evidens om sunde kost- og aktivitetsvaner i officielle anbefalinger. Formålet er at fremme sundheden i befolkningen, men en stor andel efterlever ikke de officielle anbefalinger. Flere studier peger på, at mange voksne vurderer sundheden af deres kost- og aktivitetsvaner noget mere optimistisk, end når den bliver vurderet på baggrund af videnskabelig evidens og standardiserede metoder. Denne optimistiske selvvurdering fremhæves som en potentiel barriere i sundhedsfremme. Studier peger også på, at nogle mennesker er pessimistiske, når de vurderer sundheden af deres kost- og aktivitetsvaner. Både optimistisk og pessimistisk selvvurdering indikerer, at der er afgørende forskelle på, hvordan sundhedsprofessionelle og lægfolk vurderer sundheden af kost- og aktivitetsvaner. Der er brug for mere kvalificeret viden om, hvad der ligger bag sådanne forskelle.

Formål: Det overordnede formål med denne afhandling var at undersøge forskellene mellem sundhedsprofessionelles og lægfolks vurderinger af sunde kost- og aktivitetsvaner og belyse hvad der kan ligge bag forskellene. De specifikke formål var:

- At undersøge i hvilket omfang voksne danskere vurderer sundheden af deres kost- og aktivitetsvaner mere optimistisk og pessimistisk end vurderet af sundhedsprofessionelle
- At undersøge om optimistisk og pessimistisk selvvurdering er associeret med socio-demografi, sundhed og sundhedsadfærd
- At undersøge hvilke overvejelser der ligger bag lægfolks selvvurderinger af usunde kostvaner

Metode: Omfanget af optimistisk og pessimistisk selvvurdering blev undersøgt med beskrivende statistik og associerede faktorer blev undersøgt med logistiske regressions modeller. Med kvalitative interviews blev det undersøgt, hvilke overvejelser der ligger bag lægfolks selvvurderinger. Analyserne var baseret på data fra Den nationale undersøgelse af kost og fysisk aktivitet (DANSDA). Analyserne af fysisk aktivitet omfattede data fra DANSDA 2011-2012, mens analyserne af kost omfattede data fra DANSDA 2011-2013. De 16 interviewpersoner i den kvalitative undersøgelse blev rekrutteret blandt deltagere i DANSDA 2011-2013. Optimistisk og pessimistisk selvvurdering af egne kostvaners sundhed og af fysisk aktivitetsniveau blev defineret ved at sammenligne deltagernes faktiske adfærd med deres selvvurderede adfærd. Information om faktiske kostvaner blev indsamlet via syv-dages kostdagbøger, og kostkvaliteten blev evalueret ved hjælp af et kostindeks. Information om faktisk fysisk aktivitet blev indsamlet via syv-dages skridttælling, mens information om selvvurderede kost- og aktivitetsvaner var baseret på to spørgsmål i et struktureret face-to-face

interview. Optimistisk selvvurdering af eget aktivitetsniveau blev defineret som det at tage mindre end 8.000 skridt/dag (inaktiv) og selv vurdere ens aktivitetsniveau som moderat eller hårdt. Pessimistisk selvvurdering blev defineret som det at tage mindst 10.000 skridt/dag (aktiv) og selv vurdere ens aktivitetsniveau som let eller stillesiddende. Optimistisk selvvurdering af egne kostvaners sundhed blev defineret som det at have en kostindeksscore i laveste tertil i kostindekset (usunde kostvaner) og selv vurdere ens kostvaner som sunde nok. Pessimistisk selvvurdering blev defineret som det at have en kostindeksscore i højeste tertil (sunde kostvaner) og selv vurdere ens kostvaner til ikke at være sunde nok. Alle interviewpersoner i de kvalitative interviews havde en kostindeksscore i laveste tertil. Den ene halvdel var optimistiske omkring sundheden, mens den anden halvdel var realistiske.

Resultater: I DANSDA 2011-2012 indgik 1418 voksne med valide skridtdata. Blandt de inaktive (39 %) havde 27 % en optimistisk vurdering af deres aktivitetsniveau, mens 73 % havde en realistisk vurdering. Blandt de aktive (41 %) var 50 % pessimistiske i deres vurdering, mens de øvrige 50 % var realistiske. I DANSDA 2011-2013 indgik 3014 voksne med valide kostdata. Blandt dem med usunde kostvaner (40 %) havde 55 % en optimistisk vurdering af deres kostvaners sundhed, mens 45 % havde en realistisk vurdering. Blandt dem med sunde kostvaner (28 %) var 65 % pessimistiske i deres vurdering, mens 35 % var realistiske. Fordelagtige sundhedskarakteristika, som fremragende selvvurderet helbred og normalvægt, var associeret med optimistisk selvvurdering, mens mindre fordelagtige sundhedskarakteristika, som godt selvvurderet helbred og fedme var associeret med pessimistisk selvvurdering. Derudover var det mere sandsynligt, at mænd havde en optimistisk vurdering af deres aktivitetsniveau, mens det var mere sandsynligt, at kvinder var pessimistiske i deres vurdering. Samtidig var det mere sandsynligt, at ældre havde en optimistisk vurdering af deres kostvaners sundhed, mens det var mere sandsynligt at yngre var pessimistiske i deres vurdering. Da interviewepersonerne i den kvalitative undersøgelse blev bedt om at vurdere sundheden af deres kostvaner, refererede de typisk til både sunde og usunde spisevaner. De vurderede også sundheden med reference til forskellige anbefalinger for sund kost. På den måde inkluderede interviewpersonerne deres viden om og opfattelse af sund kost i deres vurdering, men i sidste ende lod det til at være andre kriterier, der havde mere afgørende betydning. Interviewpersonerne kunne således godt vurdere, at deres kostvaner var sunde nok – selvom de på baggrund af deres viden godt vidste, at de ikke var så sunde – så længe de havde det godt. Derudover havde deres vægtstatus og bekymringer om vægt stor betydning for deres selvvurdering. Optimistisk selvvurdering synes at hænge sammen med at se sig selv som normalvægtig, ikke have erfaring med at tage på eller tabe sig og ikke bekymre sig omkring sin vægt.

Konklusion: Resultaterne i denne afhandling peger på, at en betydelig andel af voksne danskere vurderer sundheden af deres kost- og aktivitetsvaner forskelligt fra, hvordan de bliver vurderet af sundhedsprofessionelle. Derudover indikerer resultaterne, at fordelagtige sundhedskarakteristika er associeret med en optimistisk selvvurdering, mens mindre fordelagtige sundhedskarakteristika er associeret med en pessimistisk selvvurdering. Resultaterne af den kvalitative undersøgelse antyder, at det at føle sig sund og være normalvægtig fungerer som tegn på, at det, man spiser, er sundt nok, mens overvægt og bekymringer omkring personlig vægt lader til at støtte op om en mere realistisk vurdering af ens usunde kostvaner.

1. Introduction

1.1 Background

The main idea behind this thesis emerged from advisory work conducted for the Danish Veterinary and Food Administration and The Danish Agriculture & Food Council (Groth et al., 2009; Sørensen et al., 2013). Data from the Danish National Survey of Diet and Physical Activity 2005-2008 (DANSDA) indicate that Danish adults in general have rather positive attitudes toward the healthiness of own dietary habits (Groth et al., 2009). Thus, three out of four aim at eating a healthy diet every day and most of them due to their health. Furthermore, 79 % consider their diets to be healthy enough, 80 % believe that they eat enough vegetables and 67 % that they eat enough fruit. Compared to the results of actual dietary habits, which show a rather low compliance with Danish food-based dietary guidelines (Pedersen et al., 2015), Danish adults seem to be rather optimistic about the healthiness of their diets. Data from DANSDA 2005-2008 also indicate a considerable difference between Danish adults' compliance with the fruit and vegetable guideline and Danish adults' self-assessments of their intake (Sørensen et al., 2013). Among adults that to a high degree believe they eat enough vegetables, 78 % eat less than the recommended amount. The similar proportion for fruit is 40 %. Overall, the results indicate a considerable difference between assessments of healthy diets by health professionals and lay people. Potential consequences of the identified differences seem obvious: if people believe that they eat healthy enough why then change their diets? The findings led to several of questions: Is the phenomenon widespread and how big is the difference? Which consequences in a public health context have been identified? Is the same phenomenon identified with physical activity? And what is behind the difference? These questions were the starting point of this thesis.

In this thesis, 'health professionals' assessments' is defined as assessments of healthy diets and physical activity based on scientific evidence and measured with standardized and validated methods. 'Health professionals' refers to professionals with evidence-based knowledge about healthy diets and physical activity. 'Lay people's self-assessments' is defined as subjective assessments of healthy diets and physical activity not necessarily based on specialized knowledge. 'Lay people' refer to people who unlike health professionals do not necessarily have specialized knowledge about healthy diets and physical activity. Definitions are outlined in Box 1.

Health professionals' assessments	Lay people's self-assessments
Assessments of healthy diets and physical activity based on scientific evidence and standardized methods	Subjective assessments of healthy diets and physical activity not necessarily based on specialized knowledge

Box 1. Definitions of health professionals' assessments and lay people's self-assessments

1.2 Diet and physical activity – a health professional perspective

Scientific evidence shows that healthy dietary habits and a physically active lifestyle promote health and prevent obesity and non-communicable diseases such as cardiovascular disease, type 2 diabetes and certain types of cancer (Danish Health Authority, 2011; Lee et al., 2012; Nasjonalt råd for ernæring, 2011; Nordic Council of Ministers, 2014; Physical Activity Guidelines Advisoty Committee, 2008; Tetens et al., 2013; World Cancer Research Fund/American Institute for Cancer Research, 2007; World Health Organization, 2003a). Scientific evidence in relation to diet, physical activity and health is based on different types of studies, typically prospective cohort studies and randomized controlled intervention trials, showing measureable health effects of dietary intake and physical activity (World Cancer Research Fund/American Institute for Cancer Research, 2007; World Health Organization, 2003a).

1.2.1 Evidence-based guidelines on diets and physical activity

In order to promote health and prevent diet and physical activity related diseases in the general population, food and health authorities in Denmark and in other Western countries outline the scientific evidence in national guidelines on healthy diets and physical activity (Danish Veterinary and Food Administration, 2013; Food and Agriculture Organization of the United Nations, 2016; Haskell et al., 2007; Nasjonalt råd for ernæring, 2011; World Health Organization, 2010). Common to many of the food-based dietary guidelines (FBDG) in Europe and other Western countries are recommendations to limit the intake of saturated fats and trans fats, sugar and salt and increase the intake of vegetables, fruits and wholegrain (Food and Agriculture Organization of the United Nations, 2016; World Health Organization, 2015). As part of the efforts of preventing non-communicable diseases and obesity, physical activity recommendations are often included in FBDG (Danish Veterinary and Food Administration, 2013; Nasjonalt råd for ernæring, 2011; Tetens et al., 2013; USDA, 2015). The Danish FBDG were introduced in the 1970s and has been updated in accordance with scientific evidence. The latest FBDG were published in 2013 and are outlined in Box 2.

Eat a varied diet, not too much and be physically active*
Eat fruit and plenty of vegetables (600 g/day)
Eat more fish (350 g/week)
Choose wholegrain (min 75 g/day)
Choose lean meat and cold cuts (max 500 g/week)
Choose low fat dairy products
Eat less saturated fat
Eat food with less salt
Eat less sugar
Drink water

* refers to the physical activity recommendations for adults from the Danish Health Authority: *Be physically active for at least 30 minutes per day. The activity should be of moderate to high intensity and should extend beyond the usual short-term daily activities*. The concept of physical activity covers all forms of muscular work which boosts energy conversion.

Box 2. The Danish food-based dietary guidelines 2013

(Danish Health Authority, 2014; Danish Veterinary and Food Administration, 2013)

1.2.2 Promoting healthy diets and physical activity in the Danish population

In order to promote Danish FBDG in the general population, several initiatives have been implemented, in recent years for example the Keyhole label, the Whole Grain Partnership and the Salt Partnership (Danish Veterinary and Food Administration, 2016). These initiatives include strategies such as product development, availability, labelling and education. The overall aim is to make healthier choices easier for the general population. In order to encourage the population to a more physical active lifestyle, a national bike strategy has been implemented (Ministry of Transport, 2014), and every spring the Danish Cyclists' Foundation conducts the national cycling campaign "Bike to Work" (Danish Cyclists' Foundation, 2016). Furthermore, access to green public areas and active transportation are prioritized in urban planning (National Board of Health, 2003; Stockmarr et al., 2016). Overall, these initiatives contribute to emphasize the importance of physical activity and to increase the populations' opportunities for an active lifestyle.

1.2.3 Assessment of diet and physical activity

In the development of action plans and health promotion initiatives, monitoring of populations' diets and physical activity form an important basis (Nordic Council of Ministers, 2006; World Health Organization, 2015). It is a goal to monitor health behaviour in the general population as accurate as possible. Diets are typically assessed with standardised food frequency questionnaires, 24 hours recall or food diaries, while physical activity is measured with self-

reported data including frequency, duration and intensity of activities or with objective measures such as accelerometers or pedometers.

According to surveillance data, compliance with FBDG in Europe and other western countries is generally low (Amcoff et al., 2012; Hallal et al., 2012; Pedersen et al., 2015; Rossum et al., 2011; Totland et al., 2012). Data from DANSDA 2011-2013 show that 97 % of Danish adults do not comply with the recommendation for saturated fat (≤10 E%), that 83 % do not comply with the recommendation for fruit and vegetables (600 gr/10 MJ/day), and that 33 % have a diet containing more than the recommended maximum intake of sugar (≤10 E%) (Pedersen et al., 2015). Data from DANSDA also show that 34 % of Danish adults are inactive (Matthiessen, 2016). It is well established that dietary habits and physical activity are associated with socio-demographic characteristics such as gender, age and socioeconomic status (Bauman et al., 2002; Christensen et al., 2012; Elmadfa et al., 2009; Groth et al., 2014; Hallal et al., 2012; Pedersen et al., 2015). Thus, among men there is a higher proportion with unhealthy diets and among women and older people a higher proportion with sedentary behaviour (Bauman et al., 2002; Elmadfa et al., 2009; Hallal et al., 2012; Pedersen et al., 2015). Further, among those with lower educational levels and socioeconomic status a higher proportion with unhealthy diets and sedentary behaviour is found (Bauman et al., 2002; Christensen et al., 2012; Groth et al., 2014).

1.3 Studies comparing a health professional assessment of healthy diets and physical activity with lay people's self-assessments

In order to explore the preliminary questions behind this thesis, a literature search was performed in the databases Sociological Abstracts, PubMed and Web of Science. The aim was to identify relevant studies comparing a health professional assessment of healthy diets and physical activity with lay people's self-assessments. The search strings included different combinations of terms in titles and/or abstracts: diet, nutrition, food, eating, exercise, physical activity, and perception, misperception, perceived, understand, attitude, assessment, assessed, explanation, explain, meaning, awareness and health. After a thorough process of reading, searching the references of relevant papers and finally excluding studies with no specific focus on comparing assessments by health professionals and lay people, eleven papers were identified (Brug et al., 1994; Dijkstra et al., 2014; Glanz et al., 1997; Godino et al., 2014; Jansink et al., 2012; Lechner et al., 2006; Lechner et al., 1997; Ronda et al., 2001; van Sluijs et al., 2007; Variyam et al., 2001; Watkinson et al., 2010). Overall, the studies showed that considerable proportions of different population groups assess the healthiness of their own diets and physical activity level more optimistically than when assessed by health professionals with standardized methods. The studies are presented in Table 1 and 2. Five of the studies are about physical activity (Godino et al., 2014; Lechner et al., 2006; Ronda et al., 2001; van Sluijs

et al., 2007; Watkinson et al., 2010) and five about dietary intake of different foods and nutrients (Brug et al., 1994; Dijkstra et al., 2014; Glanz et al., 1997; Lechner et al., 1997) or diet quality (Variyam et al., 2001). One of the studies includes both physical activity and dietary intake (Jansink et al., 2012).

Differences between assessments by health professionals and lay people are typically examined by comparing self-assessed behaviour with a more detailed self-reporting instrument measuring adherence to the relevant guideline. The majority of the studies state that they are measuring awareness or misperception of dietary intake or physical activity level. Individuals are classified as being either optimistic or overestimating the healthiness of dietary intake or physical activity level if they classify their own behaviour as more healthy than when evaluated by means of the self-reporting instrument. Individuals are classified as pessimistic or underestimating the healthiness of a dietary intake or physical activity level if they classify their own behaviour as less healthy than the self-reporting instrument shows. Agreement between the two assessments is often classified as people being realistic in their self-assessment. Most of the papers apply different terms. However, the papers on physical activity tend to apply the terms overestimation and underestimation, where the papers on diet to a higher extent include optimistic and pessimistic self-assessment.

In this thesis, the terms being optimistic, pessimistic or realistic about the healthiness of a specific behaviour will be applied. Based on the usage of the terms in the papers presented in Table 1 and 2, the meaning of overestimation and underestimation is interpreted as being mainly related to lay people's evaluation of a specific dietary intake or physical activity, awareness to be about whether or not they are aware of the healthiness of their dietary intake or physical activity level and misperception to be about lay people having a wrong perception of their dietary intake or physical activity level. However, one of the questions behind this thesis was what is behind the difference between assessments by health professionals and lay people. The question implies the assumption that there might be more explanations behind optimistic and pessimistic self-assessments than it being about estimating own behaviour wrongly or being unaware of the unhealthiness of own behaviour. In this thesis, optimistic and pessimistic self-assessment is interpreted and applied as a more neutral description of the difference than misperception and lack of awareness. Thus, the terms are to be seen as a description of a difference (optimistic, pessimistic) or agreement (realistic) between assessments by health professionals and lay people. Definitions are evident in Box 3.

Optimistic self-assessment	**Pessimistic self-assessment**	**Realistic self-assessment**
Lay people assessing own diets or physical activity as healthier than evaluated by health professionals on the basis of scientific evidence and standardized methods	Lay people assessing own diets or physical activity as less healthy than evaluated by health professionals on the basis of scientific evidence and standardized methods	Lay people assessing own diets or physical activity as evaluated by health professionals on the basis of scientific evidence and standardized methods

Box 3. Definitions of optimistic, pessimistic and realistic self-assessment

Table 1. Studies comparing a health professional assessment of physical activity with lay people's self-assessments*

Study	Study population	Design and methods	Key findings in relation to the present thesis
Ronda et al. 2001	N=2608 18-95-year-olds Participants recruited from an intervention project in a province in the Netherlands	Cross sectional Self-administered questionnaires Self-rated (five-point likert scale) vs. self-reported (minutes and days) Awareness	Inactive: 58 % Overestimation among inactive: 61 % Among all: Overestimation: 36 % Realistic inadequate: 23 % Underestimation: 7 % Realistic, adequate: 35 % Overestimators are less likely to intend to increase their PA
Lechner et al. 2006	N=516 19-91-year-olds National random sample Netherlands	Cross sectional Self-administered questionnaires Self-rated (five-point scale) vs. self-reported (SQUASH questionnaire: activity, days, minutes) Misperception/awareness	Inactive: 33 % Overestimation among inactive: 48 % Among all: Overestimation: 16 % Low realists: 17 % Underestimation: 15 % High realists: 52 % People who, rightly or not, think their weight is adequate or who have a lower BMI, more often assume that their PA is sufficient or high
Van Sluijs et al. 2007	N=632 18-70-year-olds High-risk groups recruited from general practitioners throughout the Netherlands	Cross sectional Self-administered questionnaires + anthropometrical measures Agreement between self-rated (dichotomous) and self-reported (SQUASH questionnaire: activity, days, minutes) Awareness	Inactive: 51 % Overestimation among inactive: 61 % Among all: Overestimation: 31 % Realistic inactive: 20 % Underestimation: 6 % Realistic active: 43 % Overestimators are older, less likely to be smokers or to intend to increase their PA level, and have a lower BMI
Watkinson et al. 2010	N=365 30-50-year-olds Parental history of diabetes/at high risk of type 2 diabetes East Anglia, UK	Cross sectional HR monitors + self-administered questionnaire (self-rating of PA with 3 response response categories) + anthropometrical measures Poor recognition, unawareness, misperception	Inactive: 63 % Overestimation among inactive: 46% Among all: Overestimation: 29 % Realistic inactive: 34 % Underestimation: 23 % Realistic active: 14 %

			More likely to overestimate: males, lower BMI, younger age at completion of education, higher general health perception
Jansink et al. 2012	N=940 Type-2-diabetes patients from 57 general practices Netherlands	Cross sectional Self-administrated questionnaire Patient's perception of their PA (five-point likert scale) vs. frequencies of activities Misperception	Inactive: 51 % Awareness, among all (%) Misperception: 42 Misperception affect readiness to change PA
Godino et al. 2014	N=453 Patients from general practices in Cambridgeshire UK born between 1950 and 1975	Cross sectional HR monitor and accelerometer (Actiheart) + anthropometrical measures + clinical + PA measures + self-report survey + self-reported PA with Recent PA Questionnaire Self-rated compliance with PA guideline vs objectively measured compliance Awareness	Inactive: 57 % Overestimation among inactive: 50% Underestimation among active: 36% Awareness, among all (%): Overestimation: 29 Realistic inactive: 28 Underestimation: 16 Realistic active: 27 More likely to overestimate: lower BMI, higher PA energy expenditure and self-report PA, lower intention to increase PA and response efficacy

* The study descriptions accord with the wordings of the papers

Table 2. Studies comparing a health professional assessment of healthy diets with lay people's self-assessments*

Study	Study population	Design and methods	Key findings in relation to the present thesis
Brug et al. 1994	N=1507 Participants from the Healthy Bergeyk Project (a community-based cancer prevention intervention project in Bergeyk, Netherlands) Awareness of dietary fat intake	Cross sectional Telephone interviews Self-reported fat intake: a 25-item food frequency questionnaire, subjects divided in tertiles (low, intermediate, high-fat diets) Self-rated dietary fat intake: participants evaluation on a five-point scale (very low in fat to very high), divided into low, intermediate and high All analysis done separately for men and women	Unrealistic: 55 % Optimistic: 42 % A larger proportion of men were optimistic Female subjects who rate their personal fat intake as high are more likely to intend to reduce their fat intake than female subjects who think their fat intake is low
Glanz et al. 1997	Netherlands (NL): N=768 Working adults from the Healthy Bergeyk Project (see Brug et al. 1994) US: N=15440 Workers from Working Well (a randomized, prospective field experiment with 114 worksites and 37291 workers in US) Awareness of dietary fat	Cross sectional NL: See Brug et al. 1994 US: Self-administered questionnaire (intake very high, high, moderate, low, very low) Dietary intake: 88-item semi-quantitative food frequency questionnaire with portion sizes Fat intake was categorized into tertiles	Underestimators (optimists): NL: 37 %; US: 27 % Good estimators (realists): NL: 43 %; US: 45 % Overestimators (pessimists): NL: 21 %; US: 28 % Males were more likely to overestimate and less likely to underestimate in both samples. Highly educated persons are most often realistic (good estimators) in both samples. However, the least educated Dutch group and the most educated American group are found to be underestimators (optimists)

	intake		
Lechner et al. 1997	N=367 18-94-year-olds Random sample of the general adult Dutch population Misconceptions of vegetable and fruit consumption	Cross sectional Telephone interview Food frequency method (estimated objective intake) Subjective consumption: five-point likert scale from very low to very high	Non-compliance: Vegetables: 32 %; fruit: 56 % Inconsistent estimation: Vegetables: 30 % (94 % overestimation); fruit: 38 % (96 % overestimation) Inconsistent estimation (overestimation): Vegetables: 88 %; fruit: 65 % Intention to eat F&V predict the self-rated consumption much better than the estimated objective consumption
Variyam et al. 2001	N=2862 ≥18-year-olds Household meal planners/preparers from the 1989–90 Continuing Survey of Food Intake by Individuals (CSFII) and the Diet and Health Knowledge Survey (DHKS) US Misperception of diet quality	Cross sectional Telephone survey (DHKS) CSFII: 1-day 24-hour dietary recall+ 2-day diet record. Diet quality calculated with Healthy Eating Index (HEI). Score between 0 and 100. “Good” diets: >80, “Needs improvement”: 51-80, “Poor”: <51 Self-perceived diet quality: excellent/very good, good, and fair/poor Comparing optimists with others (realists and pessimists)	Optimists: 40 % Realists: 40 % Pessimists: 20 % More likely to be optimistic: bigger household size, males, less than high school (only lower levels of education were significant), excellent self-rated health, smokers, no reason to change diet, nutrition very important
Jansink et al. 2012	N=940 Type-2-diabetes patients from 57 general practices Netherlands Misperception of vegetable, fruit and fat intake	Cross sectional Self-administrated questionnaire Misperception defined by comparing patient’s perception of each lifestyle behaviour (five-point likert scale) with the more objective measurements of compliance (FFQ)	Non-compliance: Vegetables: 74 % Fruit: 55 % Fat: 24 % Misperception: Vegetables: 69 % Fruit: 40 % Fat: 22 % Association between misperception and readiness to change one’s lifestyle is significant for vegetables and fat
Dijkstra et al. 2014	N=1057 55–85-year-olds The Longitudinal Aging Study Amsterdam (LASA). Data from 2005/6 Netherlands Misperception of self-reported adherence to the fruit, vegetable and fish guidelines	Cross sectional Short food frequency questionnaire Self-reported dietary intake is compared with self-reported adherence to the guidelines Comparing optimists with realists	Non-compliance: Vegetables: 23 % Fruit: 31 % Fish: 64 % Overestimators: Vegetables: 19 % Fruit: 2 % Fish: 3 % Underestimators: Vegetables: 7 % Fruit: 16 % Fish: 1 % More likely to overestimate: lower educated (vegetables)

* The study descriptions accord with the wordings of the papers

The studies on physical activity presented in Table 1 show that 16-36 % of the examined populations assess their physical activity level optimistically, while 6-23 % assess their activity level pessimistically (Godino et al., 2014; Lechner et al., 2006; Ronda et al., 2001; van Sluijs et al., 2007; Watkinson et al., 2010). The studies on diet presented in Table 2 show that 2-42 % are optimistic about the healthiness of their dietary intake, while 1-28 % are pessimistic in their self-assessments (Brug et al., 1994; Dijkstra et al., 2014; Glanz et al., 1997; Jansink et al., 2012; Lechner et al., 1997; Variyam et al., 2001). Thus, optimistic self-assessments seem to be more widespread than pessimistic self-assessments. The studies focus mainly on people's optimistic self-assessments and describe different factors associated with this optimism. Many of the studies focus on the consequences. Optimistic assessors are generally found to be less likely to intend to change to healthier dietary and physical activity behaviours (Brug et al., 1994; Godino et al., 2014; Jansink et al., 2012; Lechner et al., 1997; Ronda et al., 2001; van Sluijs et al., 2007; Variyam et al., 2001), and it is suggested that optimistic self-assessments of unhealthy diets and insufficient physical activity constitute a barrier to the promotion of healthier behaviours.

The majority of the previously published studies explain the association between optimistic self-assessment and lack of intention to change behaviour by referring to the Precaution Adoption Process Model (Weinstein, 1988). In this model behaviour change is viewed as a process in different stages. In order to be motivated to initiate a behaviour change process, people need to be aware that their behaviour is a potential health risk. Accordingly, if people are not aware that they eat unhealthily or are not sufficiently physically active, they are less likely to respond to public health messages. Further, several of the studies highlight the risk of overlooking or misclassifying people in interventions based on self-assessed behaviour, with the consequence of ineffective promotion of healthier behaviours. This is specified with the Stages of Change Model (Prochaska & DiClemente, 1983; Prochaska et al., 1991). In this model, behaviour change is viewed as a process in different stages – from precontemplation to contemplation, further into preparation and action and then either maintenance or relapse – and the intervention toward individuals is matched with the stage in which the individual is classified. As optimistic self-assessments are likely to misclassify individuals, it will be expected that the intervention is unlikely to be effective.

Some of the studies characterise optimistic and pessimistic assessors. The identified characteristics are not consistent across studies. However, in the studies of physical activity, self-assessment tend to be associated with indicators of health such as a healthy weight status (Godino et al., 2014; Lechner et al., 2006; van Sluijs et al., 2007; Watkinson et al., 2010). Associations between self-assessments and indicators of health are only studied in two of the studies of dietary intake, and only one of the studies report a significant association between

self-rated health and optimistic self-assessment (Variyam et al., 2001). Eight of the eleven studies are conducted in the Netherlands (Brug et al., 1994; Dijkstra et al., 2014; Glanz et al., 1997; Jansink et al., 2012; Lechner et al., 2006, 1997; Ronda et al., 2001; van Sluijs et al., 2007). The study of Glanz et al. (1997) also includes data from the US, while the study of Variyam et al. (2001) is conducted in the US. The last two studies are conducted in the UK (Godino et al., 2014; Watkinson et al., 2010). The study designs are cross-sectional and most of the include specific samples, such as people with type 2 diabetes, older people or people from local communities.

Most of the previously published studies conclude that an important step in the development of health promotion strategies is to make people aware of their unhealthy behaviours (Brug et al., 1994; Godino et al., 2014; Jansink et al., 2012; Lechner et al., 2006, 1997; Ronda et al., 2001; van Sluijs et al., 2007; Variyam et al., 2001; Watkinson et al., 2010). Studies suggest that the complexity in assessing dietary intake and physical activity level may be one reason why people are not aware of their unhealthy behaviours (Brug et al., 1994; Dijkstra et al., 2014; Godino et al., 2014; Ronda et al., 2001; Variyam et al., 2001; Watkinson et al., 2010). Feedback on people's dietary intake and physical activity levels has been suggested as a potential strategy for making people aware of unhealthy behaviours (Brug et al., 1994; Glanz et al., 1997; Godino et al., 2014; Lechner et al., 1997; Ronda et al., 2001; van Sluijs et al., 2007; Watkinson et al., 2010). Some studies suggest that lay people's self-assessments are influenced by their knowledge about healthy behaviours and that increasing the knowledge about FBDG would increase lay people's awareness of their unhealthy behaviours (Godino et al., 2014; Lechner et al., 1997; Ronda et al., 2001; Watkinson et al., 2010). Further, some studies suggest that lay people might use their appearance, weight status or other people's behaviours as reference when assessing the healthiness of own diets and physical activity (Godino et al., 2014; Lechner et al., 2006; van Sluijs et al., 2007; Watkinson et al., 2010).

Do the identified studies answer the preliminary questions: Is the phenomenon widespread and how big is the difference? Which consequences of people's optimistic self-assessments have been identified? Is the same phenomenon identified with physical activity? And what is behind the difference? According to the studies reviewed, considerable proportions of the populations assess the healthiness of their diets and physical activity differently than when assessed by health professionals on the basis of scientific evidence. However, it has been studied only in a limited number of countries and mainly in specific population groups. Further, only one study included both diet and physical activity. In the literature there seems to be consensus that optimistic self-assessments most likely function as a barrier to the promotion of healthier dietary and physical activity behaviours. Also, most of the previously published studies seem to agree about the solution: to increase people's awareness of unhealthy diets and insufficiently physical

activity. However, no studies have been identified in the literature that has explored in depth what optimistic self-assessment is about, and the identified explanations of optimistic self-assessments appear speculative. Is it really the case that lack of awareness or misperceptions are the key issues, or lack of knowledge about FBDG? And do people assess the healthiness of their diets and physical activity with a reference to other people or their weight status and appearance? For the selection of potential strategies to enhance realistic self-assessments, more in-depth knowledge and insights to the mechanisms behind people's self-assessments is needed. This knowledge will most likely be useful in the promotion of healthier dietary habits and physical activity.

1.4 Healthy diets – lay people's perspectives

In order to obtain a broader understanding of contemporary health issues, it has been argued that public health research, policy-makers and practitioners should incorporate lay people's perspectives offered by qualitative research (Coveney, 2004; Malterud, 2001; Popay & Williams, 1996). In a review of 195 published studies on contributions from qualitative research in understanding lay people's interpretation of healthy eating, it was concluded that qualitative research was capable of finding meanings related to healthy eating that health professionals usually do not consider (Bisogni et al., 2012). Further, the authors concluded that the work of health educators and researchers would benefit from including qualitative research by gaining more insight into their audience and thus better understand their audience.

A survey of lay people's definitions of healthy eating, including all EU countries, concluded that the majority of the populations in broad terms are able to cite various aspects of dietary guidelines (Margetts et al., 1997). This is partly confirmed in qualitative studies and reviews about lay people's perspectives related to healthy eating (Bisogni et al., 2012; Falk et al., 2001; Holm, 2012; Paquette, 2005; Povey et al., 1998). However, according to these qualitative studies lay people include additional elements such as organic food, unprocessed food, regular meals and psychosocial well-being in their understanding of healthy eating – none of which are included in FBDG's. Further, it is emphasized that lay people's interpretations of healthy eating are complex and not easily convertible with scientific definitions of healthy eating (Bisogni et al., 2012; Falk et al., 2001).

On the basis of these qualitative studies there are reasons to believe that the self-assessment of healthy eating and physical activity among lay people include other elements than considered by health professionals in the quantitative studies comparing a health professional assessment with lay people's self-assessments.

1.5 A mixed method approach

Above, two different approaches are presented. Firstly, quantitative studies indicate that considerable proportions of examined populations assess the healthiness of their diets and physical activity differently than when evaluated by health professionals on the basis of scientific evidence. Optimistic self-assessment is regarded as a potential barrier in the promotion of healthier behaviours and the strategy to overcome this barrier is to initiate initiatives that promote more realistic self-assessments among lay people. Secondly, in qualitative research it has been emphasized that health professionals would benefit from gaining more insight into the perspectives of lay people and include these insights in their work.

This thesis combines those two approaches. By investigating factors associated with lay people's self-assessments in a nationally representative sample of Danish adults and combining it with in-depth explorations of considerations underlying lay people's self-assessments, the aim is to achieve a more complete understanding of what might be behind differences between the assessment of healthy diets and physical activity by health professionals and lay people. With a combination of quantitative and qualitative studies, this thesis adds to the existing knowledge of quantitative studies comparing a health professional assessment with lay people's self-assessments. In addition, the thesis contributes to the existing research by examining people's optimistic and pessimistic self-assessment of diet healthiness as well as physical activity in the general adult Danish population including an objective measure of physical activity and a more accurate measure of diet quality than applied in previous research. As FBDG and several of the above-mentioned health promotion initiatives are targeted the general population, there is a need to study the difference between assessments by health professionals and lay people in a representative sample of the general population.

Several arguments for combining quantitative and qualitative methods have been identified within the field of 'mixed method research' (Bryman, 2006; Greene et al., 1989; Johnson et al., 2007). Common to the majority of these arguments – and also the reasons of applying both quantitative and qualitative methods in this thesis – are the potentials for gaining a more complete picture of the phenomenon of interest for example by studying the phenomenon in depth as well as in width (Bryman, 2006; Greene et al., 1989; Johnson et al., 2007; Mason, 2006; Padgett, 2012). Thus, this thesis aims at elaborating and clarifying the findings of the quantitative studies with findings from the qualitative study.

There are many ways of mixing quantitative and qualitative methods (Bryman, 2006, 2007; Creswell, 2010; Frederiksen et al., 2014; Frederiksen, 2013; Padgett, 2012; Tashakkori & Creswell, 2007). The methods may be combined concurrently or sequentially. Typically one method is more dominant than the other. The integration of methods occurs in different stages

of a research projects and can be many or few. In this thesis, each specific research objective is explored with either quantitative or qualitative research methods and each sub-study is thus intact. However, the integration of the two methods is evident throughout the thesis with regard to overall design, the applied data and relations between the methods, and with regard to the interpretation of the results.

There are conceptually different views with regard to the character and value of traditional paradigms and accordingly what most importantly guides practical decisions in a research study (Greene, 2008). These views range from the assumption that different paradigms are incompatible and thus not possible to mix in the same study to the assumption that various traditional and emergent paradigms may well be embedded in or intertwined with substantive theories. An in-between position – and the position of this thesis – is the assumption that traditional paradigms are different in important ways and remain valuable but in dialog they have the potential to generate new insights and understandings (Greene, 2008).

1.6 Overall aim and specific research objectives

The overall aim of this thesis was to examine differences between assessments of healthy diets and physical activity by health professionals and lay people and to explore what might be behind such differences.

The specific research objectives were:

1. To examine the extent to which Danish adults assess the healthiness of their diets and physical activity more optimistically and pessimistically than assessed by health professionals
2. To examine if optimistic and pessimistic self-assessments of diet healthiness and physical activity are associated with socio-demography, health and health behaviours
3. To explore considerations underlying lay people's self-assessments of unhealthy diets

The thesis takes a starting point in the broader perspective on health behaviours with focusing on both diet and physical activity. During the research process, a need to focus emerged and the qualitative exploration therefore focuses on lay people's self-assessments of unhealthy diets. The thesis is based on the totality of the research conducted in connection with the three papers included in the thesis. The objectives of the papers are therefore not fully identical with the specific objectives of the thesis.

2. Material and methods

2.1 Design

The overall aim of this thesis was explored with both quantitative and qualitative research methods. Descriptive analyses based on data from DANSDA were performed to examine the extent to which Danish adults assess the healthiness of their diets and physical activity more optimistically and pessimistically than assessed by health professionals. Further, multiple logistic regression analyses were performed to examine if the differences were associated with socio-demography, health and health behaviour. In order to elaborate and clarify the findings of the quantitative studies and to explore other potential criteria in lay people's self-assessments of unhealthy diets, thematic analyses of 16 qualitative interviews with participants in DANSDA 2011-2013 were conducted.

Figure 1 gives an overview of the overall study design. The quantitative and qualitative studies were conducted sequentially, and the design of the qualitative study was inspired by the findings derived from the quantitative studies. This means that the group of interest were identified on the basis of the quantitative findings. The results of the quantitative and qualitative studies were analysed and interpreted both separately and in combination.

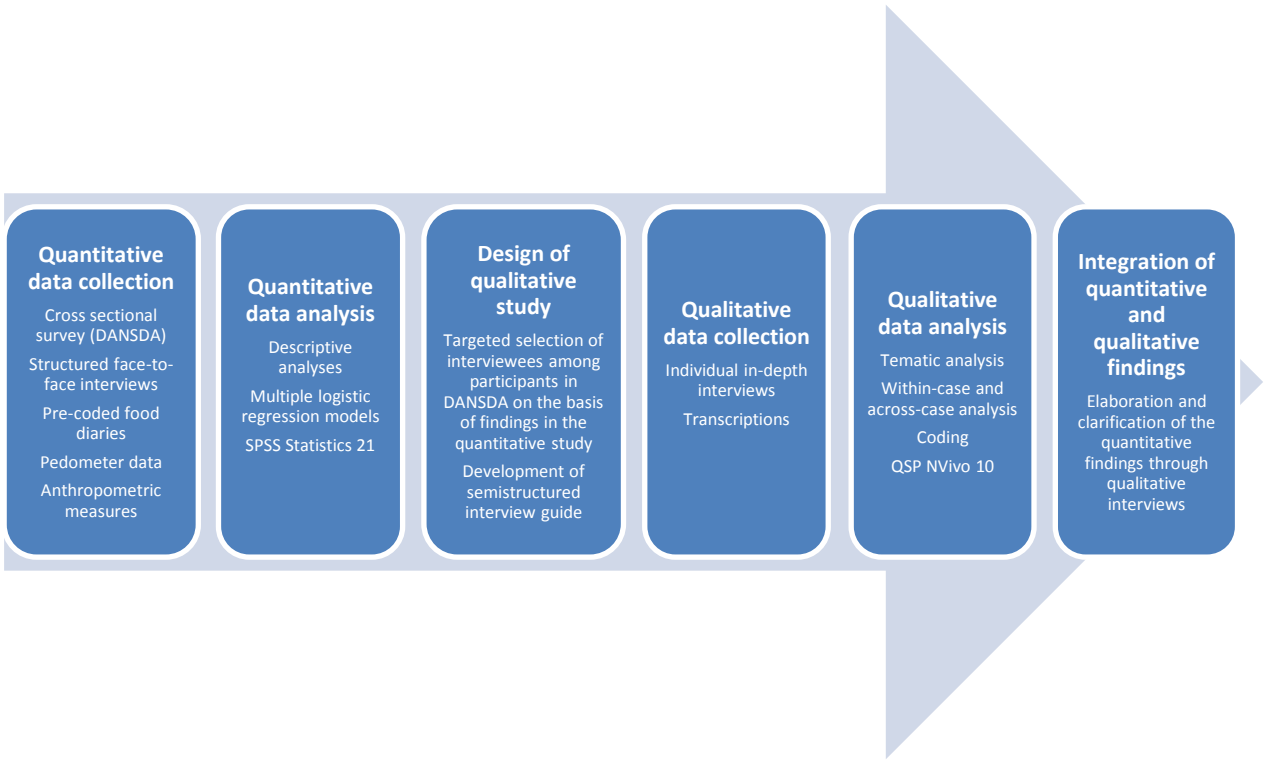

Figure 1. Illustration of the overall design and the mixing of quantitative and qualitative methods

2.2 The Danish National Survey of Diet and Physical Activity

In the quantitative studies in paper I and II data were derived from DANSDA 2011-2012 and 2011-2013, respectively. DANSDA is a cross-sectional survey where data on diet, physical activity, anthropometrics, socio-demographic characteristics and participants' meal habits and assessments of health behaviours such as dietary habits and physical activity were collected in a nationally representative sample of the Danish population (4-75 years) from spring 2011 to summer 2013 (Pedersen et al., 2015). Participants were drawn from the Danish Civil Registration System. The first DANSDA was conducted in 1985, then in 1995 and continuously in 2000-2002, 2003-2008 and finally 2011-2013. The aim of DANSDA is to monitor the Danish populations' dietary intake, physical activity and weight status, meal habits and attitudes toward healthy diets. The survey forms the basis of research and scientific advice within these themes and also provides data to research, scientific advice and legislation on the safety of foods through estimation of dietary exposure to contaminants, additives and pesticides. Finally, knowledge derived from DANSDA is used to plan, implement and evaluate nutrition and public health initiatives and policies.

In the 2011-2013 survey, a total of 7,253 individuals were drawn from the Danish Civil Registration System (CPR), and 3,946 (54 %) participated in the survey (Pedersen et al., 2015). In order to ensure sufficient language knowledge, individuals who did not speak Danish were excluded from the sample. Furthermore, to ensure sufficient knowledge about dietary intake, disabled individuals, nursing home residents and home-dwelling individuals receiving meals from outside their homes regularly were also excluded. Compared to the Danish population, individuals with basic education were underrepresented, while men and 19-54-year-olds were slightly underrepresented (Pedersen et al., 2015).

Data on diet were collected through pre-coded food diaries while data on physical activity were collected with pedometers. Furthermore, structured face-to-face interviews with a total of 60 questions were conducted including questions about participants self-assessed diet healthiness and physical activity level. The interviewer instructed the participants on how to fill out the pre-coded food and step diaries and how to wear the pedometer and did also measure participants' height, weight and waist circumference. The interview was divided in two. The first half was conducted in continuation of the instructions, and the second half when the interviewer after the registration period collected the food and step diaries.

DANSDA was conducted in accordance with the Declaration of Helsinki and approved by the Danish Data Protection Agency. The Danish National Committee on Health Research Ethics has reviewed the study protocol and reported that DANSDA did not require approval by this authority according to Danish Law.

When the analyses in paper I were conducted, the cleaning and processing of data from the second year of the data collection in DANSDA 2011-2013 was not finished. Consequently, data in paper I were derived from the first year data collection, 2011-2012. A total of 2,924 18-75-year-olds were drawn from CPR and met the inclusion criteria. Hereof, 1,515 participated in the survey and recorded their steps in the step diaries. This corresponds to a response rate of 52 %. Data in paper II were derived from the total data collection, 2011-2013. A total of 5,882 18-75-year-olds were drawn from CPR and met the inclusion criteria. Hereof, 3,014 participated in the survey and completed the pre-coded food diaries. This also corresponds to a response rate of 52 %. In paper III, interviewees were recruited among participants in DANSDA 2011-2013.

2.3 Quantitative measures

Optimistic and pessimistic self-assessment of diet healthiness and physical activity level were defined by comparing participants' actual behaviour with their self-assessed behaviour. Actual behaviours were determined with accurate assessment methods, while self-assessed behaviours were participants' subjective assessment of their own behaviour. Actual diets were measured with data from seven days pre-coded food diaries and actual physical activity was measured objectively with seven days pedometer-determined step counts recorded in pre-coded step diaries. Participants' self-assessments were collected through questions in a structured face-to-face interview. Measures of actual and self-assessed behaviours and definitions of optimistic and pessimistic self-assessment are presented in more details below along with socio-demography, health and health behaviour.

2.3.1 Pedometer-determined physical activity

Participants wore a cable-tie-sealed pedometer (Yamax SW-200, Tokyo, Japan) for seven consecutive days in waking hours except for time spent in water-based activities (bathing, showering, and swimming). In a pre-coded step diary adapted from Tudor-Locke et al. (Tudor-Locke, Lind, et al., 2004) each day participants recorded steps per day, time of pedometer attachment and removal, non-wear-time during hours awake, sickness or injury, time spent on cycling, time spent on exercise and sports and verification of properly wearing the pedometer. Trained interviewers instructed the participants on how to wear the pedometer and how to fill out the step diary in accordance with standardized procedures. To minimize reactivity, pedometers were sealed during the day (Clemes & Parker, 2009). Participants were encouraged not to modify their physical activity level during the recording period. Days with a minimum of 10 hours wear and steps between 100 and 50,000 were accepted as valid (Bassett et al., 2010; Troiano et al., 2008). Participants with a minimum of four valid days and an average of between 1000 and 25,000 steps per day were included in the analysis, unless low or high step counts could be verified by the step diaries (Tudor-Locke, Bassett, et al., 2011).

2.3.1.1.1 Adding cycling to pedometer-determined physical activity

Pedometers do not capture non-ambulatory activities, such as cycling, swimming, weight training, and horseback riding. As cycling is a common and frequently reported activity in Denmark (Matthiessen et al., 2015), cycling was adjusted for by using the conversion of cycling into step equivalents (Miller et al., 2006; Rothausen et al., 2010). In the present study, time spent on cycling was included in the pedometer-measured steps by adding 160 step equivalents per minute of cycling. To avoid overestimation, an addition of more than 10,000 step equivalents/day was truncated to 10,000 step equivalents/day.

2.3.2 Self-assessed physical activity level

Information about self-assessed physical activity was obtained with a standard question based on the idea of the questionnaire published by Saltin and Grimby (Saltin & Grimby, 1968): "If we look back at the past year, what would you say best describes your leisure activities?" The question was included in the second part of the structured interviews in DANSDA. Participants were shown the response categories and assessed their activity level accordingly. The response categories were: (1) Heavy exercise and competitive sports regularly and several times a week (vigorous); (2) Exercise or heavy gardening at least 4 hours a week (moderate); (3) Walking, biking or other light exercise at least 4 hours a week (light); (4) Reading, watching TV or other sedentary activity (sedentary). The validity of the classification of people's physical activity in the different activity levels has been substantiated in several studies (Ekelund et al., 2006; Grimby et al., 2015; Matthiessen et al., 2008), and the question has been used widely in several large population-based surveys (Christensen et al., 2012; Grimby et al., 2015; Matthiessen et al., 2008; L. Rasmussen et al., 2012).

2.3.3 Definition of optimistic and pessimistic self-assessment of physical activity level

Optimistic and pessimistic self-assessment of physical activity level were defined by comparing participants' pedometer-determined physical activity with participants' self-assessed activity level. Optimistic self-assessment was defined as participants taking less than 8,000 steps/day and assessing their activity level as moderate or vigorous (Box 4 and Figure 2). Pessimistic self-assessment was defined as participants taking at least 10,000 steps/day and assessing their activity level as sedentary or light.

Optimistic self-assessment of physical activity	Pessimistic self-assessment of physical activity
Taking less than 8,000 steps/day and assessing own physical activity level as moderate or vigorous	Taking at least 10,000 steps/day and assessing own physical activity level as sedentary or light

Box 4. Definitions of optimistic and pessimistic self-assessment of physical activity

The cut-off points were chosen on the basis of suggested international standards, presented in Table 3 (Tudor-Locke & Bassett, 2004; Tudor-Locke et al., 2013; Tudor-Locke, Craig, et al., 2011). According to these standards, a minimum of approximately 10,000 steps/day is classified as an active/highly level of physical activity, while less than 7,500 steps/day is classified as a sedentary/light activity level. Taking less than 7,000-8,000 steps/day is considered equivalent not to meet the minimum physical activity recommendation and is defined as being inactive (Tudor-Locke et al., 2013). In Denmark, the minimum physical activity recommendation is to be physically active 30 minutes each day. This corresponds to 8,000 steps/day (Tudor-Locke, Craig, et al., 2011). Therefore, a cut-off point of 8,000 steps/day was chosen in the present study.

As shown in Table 3, steps between 8,000-9,999 steps/day would be classified as being somewhat active. It was considered not to be reasonable to classify participants taking 8,000-9,999 steps/day as optimistic assessors if they assessed their physical activity to be moderate/vigorous. Nor it was considered reasonable to categorize them as pessimistic assessors if they assessed their activity as sedentary/light. Therefore, it was decided not to include participants taking 8,000-9,999 steps/day in the analyses (N=287).

Table 3. Classification of step-determined physical activity levels based on international standards*

Steps/day	Activity level	Activity level compared with the recommendation
<5,000	Sedentary	Inactive
5,000-7,999	Light	Inactive
8,000-9,999	Somewhat	Active
10,000-12,499	Active	Active
≥12,500	Highly active	Active

* (Tudor-Locke & Bassett, 2004; Tudor-Locke et al., 2013; Tudor-Locke, Craig, et al., 2011)

		Lay people's self-assessed physical activity level	
		Moderate/vigorous	Light/sedentary
A health professional assessment of physical activity	<8,000 steps/day	Optimistic assessors	Realistic assessors
	≥10,000 steps/day	Realistic assessors	Pessimistic assessors

Figure 2. Classification of optimistic, realistic and pessimistic assessors of physical activity

2.3.4 Estimated diet quality

Participants recorded their dietary intake in a pre-coded food diary for seven consecutive days (Biltoft-Jensen et al., 2009; Pedersen et al., 2015). The food diary was structured according to a typical Danish meal pattern (breakfast, lunch, dinner and in-between meals) and included the most commonly eaten foods and drinks with an opportunity to add food and drinks not included in the pre-codes. Portion size was estimated using household measures (cups, glasses etc.) and photographs in a booklet containing a series of 41 photographs with 6 different portion sizes. Intakes of energy, nutrients and food items were calculated for each participant using the software system GIES version 1.000.i6 (developed at the National Food Institute, Technical University of Denmark, Søborg, Denmark) and the Danish Food Composition Databank version 7.0 (National Food Institute Technical Unversity of Denmark, 2009).

The overall diet quality of each participant was evaluated by means of a diet index score based on five food and nutrient guidelines from the Danish FBDG 2013 (Box 5): energy from saturated fat (max 10 E%), energy from added sugar (max 10 E%), intake of fruits and vegetables (600 g/10 MJ/day), intake of fish (350 g/10 MJ/week) and intake of wholegrain (min 75 g/10 MJ/day) (Tetens et al., 2013). The diet index was a slightly modified version of a validated diet index based on the Danish FBDG 2005 (Knudsen et al., 2012). For each participant, a score between 0 and 1 was calculated according to the compliance with each of the five guidelines included in the index. The total score was calculated as the sum of the five scores, ranging from 0 to 5 where 0 was most far from compliance with the dietary guidelines and 5 was compliance with all five dietary guidelines.

Saturated fat: ≤10 E%
Added sugar: ≤10 E%
Fruit and vegetables: 600 g/10 MJ/day
Fish: 350 g/10 MJ/week
Wholegrain: ≥75 g/10 MJ/day

Box 5. The five food and nutrient guidelines included in the diet index

Since less than 1 % of participants had a diet index score of 5 this was not a relevant cut-off point for distinguishing high and low diet quality. To distinguish participants with low, intermediate and high diet quality, participants were divided in tertiles according to the total diet index score. The tertiles were estimated with unweighted data. A relative classification is in accordance with previous published studies (Brug et al., 1994; Glanz et al., 1997). Participants with a diet index score in the lowest third of the total diet index were defined as having unhealthy diets, and participants with a diet index score in the highest third were defined as having healthy diets. The intermediate diet index score was defined as somewhat healthy. Thus, the categorization was relative and healthy diets were not necessarily equivalent to complying with the five included guidelines.

2.3.5 Self-assessed diet healthiness

Information about self-assessed diet healthiness was obtained with the following question: Do you consider your dietary habits to be healthy enough? The question was included in the first part of the structured face-to-face interview in DANSDA. The interviewer probed the responses of the participants and chose a category accordingly. The response categories were: (1) Yes, to a high degree; (2) Yes, to some degree; (3) No, only partly; and (4) No, not at all. Due to a low response rate in category 4 (5.2 %), category 3 and 4 were merged.

2.3.6 Definition of optimistic and pessimistic self-assessment of diet healthiness

Optimistic and pessimistic self-assessment of diet healthiness was defined by comparing participants' estimated diet quality with participants' self-assessed diet healthiness. Highly optimistic self-assessment was defined as having a low diet index score and assessing own diet to a high degree healthy enough (Box 6 and Figure 3). Somewhat optimistic self-assessment was defined as having a low diet index score and assessing own diet to some degree healthy enough or having an intermediate diet index score and assessing own diet to a high degree healthy enough. Highly pessimistic self-assessment was defined as having a high diet index score and assessing own diet not to be healthy enough. Somewhat pessimistic self-assessment was defined as having a high diet index score and assessing own diet to some degree healthy

enough or having an intermediate diet index score and assessing own diet not to be healthy enough.

Highly optimistic self-assessment of diet healthiness Having a low diet index score and assessing own diets to a high degree healthy enough	**Highly pessimistic self-assessment of diet healthiness** Having a high diet index score and assessing own diets not to be healthy enough
Somewhat optimistic self-assessment of diet healthiness Having a low diet index score and assessing own diets to some degree healthy enough Having an intermediate diet index score and assessing own diets to a high degree healthy enough*	**Somewhat pessimistic self-assessment of diet healthiness** Having a high diet index score and assessing own diets to some degree healthy enough Having an intermediate diet index score and assessing own diets not to be healthy enough*

Box 6. Definitions of optimistic and pessimistic self-assessment of diet healthiness
(*not included in the logistic regression models)

		Lay people's self-assessed diet healthiness		
		To a high degree healthy	To some degree healthy	Partly/not at all healthy
A health professional assessment of diet quality	Unhealthy diets	Highly optimistic assessors	Somewhat optimistic assessors	Realistic assessors
	Somewhat healthy diets	Somewhat optimistic assessors	Realistic assessors	Somewhat pessimistic assessors
	Healthy diets	Realistic assessors	Somewhat pessimistic assessors	Highly pessimistic assessors

Figure 3. Classification of optimistic, realistic and pessimistic assessors of diet healthiness

2.3.7 Socio-demographic, health and health behavioural characteristics

Information about educational level, household income, self-rated health, elevated cholesterol, slimming diet and smoking behaviour, self-assessed diet healthiness and leisure time physical activity were obtained in the structured DANSDA face-to-face interview. Information on gender

and age were derived from the Danish Civil Registration System. The variables are presented in Table 4 and described more in detail below.

Educational level was measured with five questions: 1) Which school education do you have? (‘Attending school now’, ‘≤7 years of school’, ‘8–9 years of school’, ‘10–11 years of school’, ‘Upper secondary school’, ‘Other (including foreign schools), note which school education’), 2) Did you complete any education after school? (‘Yes’, ‘No, but I am currently studying or in vocational training, ‘No’, ‘Don’t know’, 3) Note which education you have completed or are currently attending? 4) How long time did/does it take? (Years, months, don’t know). The fifth question summarized the participants’ educational level in one of nine response categories: ’No completed education after school’, ‘Semi-skilled worker education’, ’Basic vocational or basic business education’, ’Trainee, vocational or business education’, ’Other vocational education’, ’Short higher education (less than 3 years)’, ’Medium higher education (3-4 years)’, ’Long higher education (at least 5 years)’.

Household income was measured with the question ‘What was the total income (DKK) of your household last year, before taxes and deductions?’ Participants were shown the response-categories: Less than 100.000, 100.000-149.999, 150.000-199.999, 200.000-249.999, 250.000-299.999, 300.000-399.999, 400.000-499.999, 500.000-599.999, 600.000-699.999, 700.000-799.999, 800.000-899.999, 900.000-999.999, 1 million or more.

Self-assessed physical activity and self-assessed diet healthiness were measured with the questions described above in paragraph 2.3.2 and 2.3.5, respectively. Smoking behaviour was measured with the question ‘Do you smoke?’ (‘Yes, daily’, ‘Yes, at least once a week’, ‘Yes, but less frequently than once a week’, ‘No, I have stopped’, ‘No, I have never smoked’) and slimming diet was measured with the question ‘Have you ever been on a slimming diet?’ (‘No, never’, ‘Yes, currently’, ‘Yes, within the last month’, ‘Yes, within the last 3 months’, ‘Yes, within the last half year’, ‘Yes, within the last year’, ‘More than one year ago’). Self-rated health was measured with the question ‘In general, how would you say your health is?’ (‘Excellent’, ‘Very good’, ‘Good’, ‘Fair’, ‘Poor’). Elevated cholesterol was measured with the question ‘Do you have any of the listed health problems, diseases, disorders and illnesses?’ Elevated cholesterol was one of nine listed health problems, diseases, disorders and illnesses: Diabetes, high blood pressure, heart disease/heart attack, stroke, elevated cholesterol, food allergy, overweight, asthma, osteoporosis, none. In case of doubt, the participant was asked to include health problems etc. diagnosed by a doctor. However with regard to overweight, it was the participant’s own perception.

Several of the questions in the DANSDA interview were inspired or directly translated from questions included in The Danish Health and Morbidity Surveys carried out by The Danish National Institute of Public Health, University of Southern Denmark. In this thesis, it concerns educational level, household income, self-assessed physical activity level, smoking behaviour, self-rated health, and elevated cholesterol. The Danish Health and Morbidity Survey is a cross-sectional, national representative, health survey among the adult population in Denmark (Ekholm et al., 2009), and it has been carried out in 1987, 1994, 2000, 2005, 2010 and 2013. Data from the survey have been widely used in international monitoring of health and morbidity indicators by Eurostat, the World Health Organization (WHO), the Organisation for Economic Co-operation and Development (OECD) and the European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) (Ekholm et al., 2009).

2.3.8 Anthropometric measurements

Height, weight and waist circumference were measured using standardized procedures. Weight was measured with an electronic scale (ADE Germany) with an accuracy of 0.1 kg, while wearing light indoor clothing without shoes, belt or sweater and after having emptied the bladder. Height was measured with a portable stadiometer (Charder HM200P Portstad) with an accuracy 0.1 cm. Waist circumference was measured with a tape measure in a horizontal line between the hip bone and the lowest rib and with an accuracy of 1.0 cm. All anthropometric measurements were made twice and an average was calculated. BMI is calculated from weight and height: weight divided by height squared. The classification of weight status and abdominal weight status was based on international standards (World Health Organization, 2000).

Table 4. Variables included in the multiple logistic regression models

Variables	Original wording	Original response categories	Response categories
Socio-demography			
Gender[a]			Men Women
Age groups, years[a]			18-24 25-44 45-64 65-75
Educational level	Which school education do you have? Have you completed any education after school? Which education? How long time did it take?	No completed education after school Semi-skilled worker education Basic vocational or business education Trainee, vocational or business education Other vocational education Short higher education Medium higher education Long higher education	Basic school Upper secondary school[b] Vocational Short higher Medium higher Long higher
Household income, Danish kroner (1 Euro = 7.45 Danish kroner)	What was the total income of your household last year, before taxes and deductions?	Less than 100.000 DKK[c] 100.000-149.999 150.000-199.999 200.000-249.999 250.000-299.999	<250.000 250.000-399.999

		300.000-399.999	
		400.000-499.999	400.000-599.999
		500.000-599.999	
		600.000-699.999	600.000-799.999
		700.000-799.999	
		800.000-899.999	≥800.000
		900.000-999.999	
		1 million or more	
Health behaviour			
Self-assessed physical activity level, leisure time	If we look back at the past year, what would you say best describes your leisure activities?	Heavy exercise and competitive sports regularly and several times a week	Vigorous
		Exercise or heavy gardening at least 4 hours a week	Moderate
		Walking, biking or other light exercise at least 4 hours a week	Light
		Reading, watching TV or other sedentary activity	Sedentary
Self-assessed diet healthiness	Do you consider your dietary habits to be healthy enough?	Yes, to a high degree	Yes, to a high degree
		Yes, to some degree	Yes, to some degree
		No, only partly	No, only partly/not at all
		No, not at all	
Smoking behaviour	Do you smoke?	Yes, daily	Yes
		Yes, at least once a week	
		Yes, but less frequently than once a week	
		No, I have stopped	No
		No, I have never smoked	
Slimming diet	Have you ever been on a slimming diet?	No, never	No
		Yes, now	Yes, now
		Yes, within the last month	Yes, within the last year
		Yes, within the last 3 months	
		Yes, within the last half year	
		Yes, within the last year	
		More than one year ago	More than one year ago
Health			
Self-rated health	In general, how would you say your health is?	Excellent	Excellent
		Very good	Very good
		Good	Good
		Fair	Fair/poor
		Poor	
Elevated cholesterol	Do you have any of the listed health problems, diseases, disorders and illnesses?	Yes, elevated cholesterol	Yes
		No, elevated cholesterol	No
Weight status[d]			Underweight and normal weight (BMI <25)
			Overweight (BMI 25 - <30)
			Obese (BMI ≥30)
Abdominal weight status (waist circumference)[d]			Healthy (men: <94 cm; women: <80 cm)
			Abdominal overweight (men: 94-101 cm; women: 80-87 cm)
			Abdominal obesity (men: ≥102 cm; women: ≥88 cm)

[a] Information derived from the Danish Civil Registration System

[b] 'Upper secondary school' includes the response category of the question 'Which school education do you have?'

[c] 7.45 Danish kroner = 1 Euro

[d] Information derived from anthropometric measures

2.4 Statistical analyses

In descriptive analyses group differences were tested using Chi-square test for categorical variables and ANOVA test for continuous variables with a significance level of 0.05. Results are presented overall and by gender. In order to account for non-response bias, the DANSDA sample was weighted according to gender, age and education using census data from Statistics Denmark in the year 2012 (Stockmarr, 2014). The weights were computed by DTU Compute. All results of the descriptive analyses, except for study sample characteristics (Table 6 and 12), were based on weighted data.

Multiple logistic regression models were used to analyse factors associated with optimistic self-assessment and pessimistic self-assessment of physical activity and diet healthiness, respectively. Results are presented as odds ratios (OR) with 95 % confidence intervals (CI). In the analysis of optimistic self-assessment of physical activity, optimistic assessors were compared to realistic assessors, and the analysis was conducted among participants taking less than 8,000 steps/day. In the analysis of pessimistic self-assessment, pessimistic assessors were compared to realistic assessors among participants taking at least 10,000 steps/day. In the analysis of optimistic self-assessment of diet healthiness, highly optimistic assessors were compared with realistic assessors, and the analysis was conducted among participants with a low diet index score. In the analysis of pessimistic self-assessment of diet healthiness, highly pessimistic assessors were compared with realistic assessors among participants with a high diet index score. Somewhat optimistic and somewhat pessimistic assessors, respectively, were not included in the outcome, due to a risk of misclassifying participants as optimistic or pessimistic assessors based on the response that they consider their diets to some degree healthy enough. However, sensitivity analyses were performed where somewhat optimistic assessors and somewhat pessimistic assessors, respectively, were included in the outcome.

The six outcomes were analysed using similar logistic regression techniques. All potential explanatory variables of interest were included in the first model of the analysis of physical activity as well as diet healthiness: gender, age, educational level, household income, weight status, abdominal weight status, elevated cholesterol, self-rated health, slimming diet, and smoking behaviour. Furthermore, the variable ‘self-assessed diet healthiness’ was included in the analyses of physical activity, while ‘self-assessed leisure time physical activity’ was included in the analyses of diet. Using backward selection, the least significant variable was removed model by model until all variables in the model were significant ($P<0.05$). Gender, age and education were kept in the model as they are known to be associated with the non-response proportion. Interactions between the remaining explanatory variables were entered after the initial model reductions and were subsequently tested using the same backward selection procedure as described above. If the interactions with gender were statistically significant, it was

considered to split the analyses for men and women. However, it was preferred not to split the data to keep the number of subjects in the analyses as high as possible. The goodness of fit of the initial logistic regression models was assessed using Hosmer-Lemeshow goodness of fit.

In order to examine how different cut-off points might affect the proportions of participants being optimistic or pessimistic in the self-assessment of diet healthiness and physical activity, respectively, sensitivity analyses involving alternative cut-off points were conducted. Thus, the extent of optimistic self-assessments of diet healthiness was analysed among the quartile with the lowest diet index score and the extent of pessimistic self-assessment was analysed among the quartile with the highest diet index score. Extent of optimistic self-assessment of physical activity was analysed among participants with less than 7,500 steps/day and among people with less than 8,500 steps/day, while extent of pessimistic self-assessment was analysed among participants with at least 9,500 steps/day and at least 10,500 steps/day.

As pedometer data included waking hours and participants' self-assessed activity level refers to leisure time activity, misclassification of pessimistic assessors might have occurred. This may occur with a combination of a physically demanding occupation and a sedentary leisure time. In order to examine this issue, sensitivity analyses were conducted. First, in a cross tabulation it was examined if the proportion of pessimistic assessors was larger among participants with a physical demanding occupation compared to participants with a sedentary occupation ($P<0.05$). Second, in order to examine if occupational activity was associated with pessimistic self-assessment of physical activity, a variable measuring 'occupational activity' was included in the logistic regression model. The variable classified participants in DANSDA into one of four different levels of occupational activity during the last 12 months: mainly sedentary (sedentary); predominantly standing or walking, but without strenuous work (light); standing or walking with a good deal of lifting or carrying (moderate); heavy or rapid labour (heavy).

All analyses were performed using IBM SPSS Statistics 21.

2.5 Qualitative interviews and analysis

Sixteen qualitative, individual interviews were conducted to obtain in-depth understandings of considerations underlying lay people's self-assessments of unhealthy diets. In the following, interviewees, the data collection including the interview guide and the analysis are presented.

2.5.1 Interviewees

Interviewees were recruited among participants in DANSDA 2011-2013 and were chosen in accordance with definitions of optimistic and realistic assessors in the quantitative study. All 16 interviewees had a diet index score in the lowest third of the total diet index. With regard to the question "Do you consider your dietary habits to be healthy enough?" seven of the 16 interviewees had been categorized as "yes, to a high degree" and one "yes, to some degree" and all eight were categorized as 'optimistic assessors'. Eight interviewees had been categorized as "no, only partly" and they were categorized as 'realistic assessors'. Given limited resources, it was not possible to select a sample that might facilitate a systematic exploration of each of the factors found in the logistic regression analyses to be associated with optimistic self-assessment. As dietary intake, perceptions of healthy eating and attitudes related to diet vary by gender, age and education (Christensen et al., 2012; Elmadfa et al., 2009; Groth et al., 2014; Margetts et al., 1997; Pedersen et al., 2015; Wardle & Steptoe, 2003), interviewees were purposively selected with a view to obtaining a differentiated sample with regard to each of these dimensions. In order to explore the aim of the qualitative study, 16 interviewees were considered satisfactory. A few more interviewees could be recruited, if this turned out not to be the case. With a few interviews left, no new substantive information was acquired. However, all 16 interviews were conducted. Characteristics of the interviewees are presented in Table 5. As it transpired from the analysis that weight status was a relevant characteristic of the interviewees, weight status, along with interviewees' gender, age and educational level, are included in Table 5. All interviewees lived within the area of greater Copenhagen.

Interviewees were contacted by phone. They were reminded about their participation in DANSDA and about then having given consent to being contacted again in case of further studies. They were informed about the content of the interview, their anonymity and their right to withdraw from the study at any time. All who were contacted were willing to participate. Due to lack of time, one interviewee cancelled the interview, and a replacement interviewee was recruited. All interviewees received a confirmation by e-mail, including a repetition of interview content and assurance of anonymity as well as practical details.

Table 5. Characteristics of interviewees (adults with unhealthy dietary habits): Gender, age, educational level and weight status. Names are pseudonyms

		Optimistic assessors				Realistic assessors			
	Age (years)	Basic/ Vocational education	Short higher education	Medium higher education	Long higher education	Basic/ Vocational education	Short higher education	Medium higher education	Long higher education
Women	25-34		Trine[a]			Katrine[a]			
	35-44								
	45-54			Lene[a]			Dorte[b]		Pernille[a]
	55-64		Hannah[a]		Karen[a]			Lisbeth[c]	
Men	25-34								Jakob[a]
	35-44	Samir[a]			Lars[a]	Marko[b]			
	45-54				Mikael[b]	Karsten[b]		Niels[b]	
	55-64	John[b]							

a: normal weight (BMI 18.5-24.9); b: overweight (BMI 25-29.9); c: obese (BMI≥30)

2.5.2 Interview guide and data collection

The semi-structured interview guide (appendix I) was developed for the purpose of exploring the considerations underlying self-assessments of unhealthy diets. The interviews were conducted in February and March 2015, a period from two to four years after the interviewees had participated in DANSDA 2011-2013. Following the introductory remarks, interviewees were therefore asked about changes in their lives with regard to education, work, family and dietary habits in the period between their participation in DANSDA and the present interview. In order to obtain initial descriptions of the ways in which food and meals were characterized, interviewees were then asked about their meals the previous day. Next, the interviewer asked the same question as in DANSDA, and which was used to categorize interviewees as being either optimistic or realistic assessors: Do you consider your dietary habits to be healthy enough? Interviewees' thoughts and reflections on this issue were of particular interest, and follow-up questions were posed in order to explore the considerations behind the initial responses. Subsequently, interviewees were shown the response categories applied in DANSDA and were asked to place themselves under one of the four pre-defined response categories that best described how they assessed the healthiness of their diets. Additional follow-up questions were also posed on this point. Since diet healthiness was a key concept, interviewees were asked questions regarding their perception of health and healthy eating and the personal importance of these for the interviewee. In order to further clarify the interviewees' standards for what 'healthy *enough'* might entail and to clarify the gap between interviewees' perceptions of healthy eating and the scientific standards by which they have been classified, interviewees were asked about sources of their knowledge, followed by questions about their knowledge about Danish FBDG and the potential use of these guidelines. An overview of themes in the interview guide is presented in Box 7.

Questions about the interviewees' behaviour and health were asked in an open manner, leaving it to each of the interviewees to choose what they wanted to talk about. Questions about body weight in general and interviewees' personal body weight were not included in the interview guide and only became part of the interview when interviewees raised these topics themselves.

Potential changes (education, work, family and dietary habits)
Yesterday's meal
Do you consider your dietary habits to be healthy enough?
Perceptions of healthy/unhealthy eating
Importance of healthy eating
Perception of health, description of a healthy/unhealthy person
Assessment of own health and health lifestyle
Guidelines and other sources of knowledge about healthy eating
Knowledge about Danish FBDG

Box 7. Themes in the interview guide

The interview guide was tested in a pilot interview and minor adjustments followed. The interviewer introduced herself as a sociologist with an interest in the perspective of the interviewee with regard to healthy eating. The interest was not nutrition and their specific dietary intake. Most interviews were conducted in the home of the interviewee. However, one interview was conducted at the work place of the interviewee and one at the workplace of the interviewer. Most of the interviews were 40-60 minutes long and the average was 50 minutes. The same interview guide was applied in all interviews. However, in accordance with qualitative methodology and the dynamic of a semi-structured interview, the formulation and order of questions varied and additional questions were included when relevant. Interviews were recorded on a digital voice recorder and transcribed to word level accuracy. Transcriptions were carefully checked.

2.5.3 Analysis

A thematic analysis of the interviews was performed, primarily explorative, however including predefined themes and with a pre-understanding from the results of the quantitative analyses. The analytic work was a dynamic process of reading, identifying themes and coding in multiple rounds. The interviewer (1) noted reflections and impressions of each interview following its completion and summarized pronounced themes and issues, (2) read each transcribed interview, noted content related to predefined themes and identified new themes, (3) summarized each interview and noted how the interviewee contributed to clarify the research objective, (4) summarized themes and identified recurring themes across interviews, (5) discussed themes with co-author and determined salient themes that could help clarify the research objective and further, listed corresponding codes, (6) read and coded each interview in

accordance with the coding list. Next step in the analytic process was to compare themes across the optimistic and realistic assessors. As such, the analytic process started after the first conducted interview. The identified themes and the interpretation hereof were regularly discussed with a group of sociologist and anthropologist researchers within the field of food. The analytic process was inspired by Miles and Huberman (Miles & Huberman, 1994) and Kvale and Brinkman (Kvale & Brinkmann, 2009) and the qualitative software package NVivo 10 was used to code and analyse data.

3. Results

3.1 Pedometer-determined versus self-assessed physical activity

3.1.1 Study population

In DANSDA 2011-2012, a total of 1515 adults (18-75 y) recorded their steps. This corresponds to a response rate of 52 %. Due to incomplete physical activity data, 97 subjects were excluded. Accordingly, 1418 participants provided valid steps and were included in the analyses. The gender distribution was 48 % men and 52 % women, and mean age was 47 years for both men and women. Forty one percent reported having completed a short, medium or long higher education. Study sample characteristics are evident in Table 6a. Among inactive adults, there was a higher number of women and older adults, lower educated and adults with unfavourable health and behavioural characteristic compared to the total sample. Among active, there was a higher number of younger adults, higher educated and adults with favourable health and behavioural characteristics compared to the total sample (Table 6b).

Table 6a. Study sample characteristics in the study of physical activity

	All N=1418	Men N=675	Women N=743	P-value[a]
Socio-demography				
Gender (%, N)				0.075
Men	47.6 (675)	-	-	
Women	52.4 (743)	-	-	
Age groups, years (%, N)				0.206
18-24	10.2 (144)	9.2 (62)	11.0 (82)	
25-44	32.9 (467)	34.1 (230)	31.9 (237)	
45-64	40.7 (577)	39.0 (263)	42.3 (314)	
65-75	16.2 (230)	17.8 (120)	14.8 (110)	
Age, years (mean, SD)	47.2 (15.6)	47.4 (15.8)	47.0 (15.5)	0.575
Educational level (%, N), N=1408				0.001
Basic school	12.9 (181)	11.8 (79)	13.8 (102)	
Upper secondary school	7.4 (104)	6.6 (44)	8.1 (60)	
Vocational	38.7 (545)	42.5 (285)	35.2 (260)	
Short higher	8.0 (113)	9.0 (60)	7.2 (53)	
Medium higher	20.7 (292)	16.6 (111)	24.5 (181)	
Long higher	12.3 (173)	13.6 (91)	11.1 (82)	
Household income[b], DKK (%, N), N=1298				0.033
<250.000	17.9 (232)	15.8 (101)	19.9 (131)	
250.000-399.999	19.5 (253)	17.7 (113)	21.2 (140)	
400.000-599.999	21.1 (274)	20.8 (133)	21.4 (141)	
600.000-799.999	21.7 (282)	23.8 (152)	19.7 (130)	
≥800.000	19.8 (257)	21.9 (140)	17.8 (117)	
Health behaviour				
Steps/day (mean, SD)	8367 (3482)	8529 (3485)	8220 (3474)	0.095
Cycling in steps/day (mean, SD)	1322 (2278)	1249 (2273)	1387 (2282)	0.256
Steps/day incl. cycling (mean, SD)	9689 (4352)	9779 (4317)	9607 (4385)	0.458
Steps/day incl. cycling, categorical (%, N)				0.610
<8,000 steps/day incl. cycling (%, N)	37.1 (526)	36.0 (243)	38.1 (283)	
8,000-9,999 steps/day incl. cycling (%, N)	20.2 (287)	20.0 (135)	20.5 (152)	
≥10,000 steps/day incl. cycling (%, N)	42.7 (605)	44.0 (297)	41.5 (308)	
Self-assessed PA level, leisure time (%, N), N=1406				<0.001
Vigorous	5.7 (80)	8.2 (55)	3.4 (25)	
Moderate	34.4 (483)	40.2 (269)	29.0 (214)	
Light	53.5 (752)	44.5 (298)	61.6 (454)	

	Sedentary	6.5 (91)	7.0 (47)	6.0 (44)
Self-assessed diet healthiness (%, N), N=1417				0.140
	High degree	24.4 (346)	23.9 (161)	24.9 (185)
	Some degree	51.5 (730)	51.6 (348)	51.5 (382)
	Partly	20.9 (296)	20.3 (137)	21.4 (159)
	Not at all	3.2 (45)	4.3 (29)	2.2 (16)
Smoking behaviour (%, N), N=1406		20.8 (293)	21.9 (147)	19.8 (146)	0.332
Slimming diet (%, N), N=1407				<0.001
	No	58.6 (825)	74.3 (498)	44.4 (327)
	Yes, now	6.3 (89)	4.0 (27)	8.4 (62)
	Yes, within the last year	11.0 (155)	7.8 (52)	14.0 (103)
	Yes, more than one year ago	24.0 (338)	13.9 (93)	33.2 (245)
Health				
Weight status (%, N), N=1348				<0.001
	Normal weight (BMI <25)	42.9 (578)	35.9 (235)	49.5 (343)
	Overweight (BMI 25 - <30)	40.5 (546)	46.6 (305)	34.8 (241)
	Obese (BMI ≥30)	16.6 (224)	17.6 (115)	15.7 (109)
Abdominal weight status (%, N), N=1333				<0.001
	Healthy[c]	41.8 (557)	46.4 (300)	37.5 (257)
	Abdominal overweight[d]	26.3 (350)	28.1 (182)	24.5 (168)
	Abdominal obesity[e]	32.0 (426)	25.5 (165)	38.0 (261)
Elevated cholesterol, N=1410		12.4 (175)	12.4 (83)	12.4 (92)	0.972
Self-rated health (%, N), N=1407				0.343
	Excellent	23.8 (335)	24.5 (164)	23.2 (171)
	Very good	38.7 (545)	36.7 (246)	40.6 (299)
	Good	30.1 (424)	31.9 (214)	28.5 (210)
	Fair/poor	7.3 (103)	6.9 (46)	7.7 (57)

[a] Gender differences. Tested using Chi-square test for categorical variables and ANOVA test for continuous variables (P<0.05)

[b] 7.45 Danish kroner = 1 Euro

[c] Men: <94 cm; women: <80 cm

[d] Men: 94-101 cm; women: 80-87 cm

[e] Men: ≥102 cm; women: ≥88 cm

Table 6b. Characteristics of inactive (<8,000 steps/day) and active (≥10,000 steps/day) participants

	All N=1418	<8,000 steps/day N=526	≥10,000 steps/day N=605
Socio-demography			
Gender (%, N)			
Men	47.6 (675)	46.2 (243)	49.1 (297)
Women	52.4 (743)	53.8 (283)	50.9 (308)
Age groups, years (%, N)			
18-24	10.2 (144)	7.8 (41)	12.1 (73)
25-44	32.9 (467)	23.6 (124)	39.3 (238)
45-64	40.7 (577)	42.2 (222)	39.0 (236)
65-75	16.2 (230)	26.4 (139)	9.6 (58)
Age, years (mean, SD)	47.2 (15.6)	51.8 (15.8)	44.0 (14.8)
Educational level (%, N), N=1408			
Basic school	12.9 (181)	18.2 (95)	8.3 (50)
Upper secondary school	7.4 (104)	6.7 (35)	8.3 (50)
Vocational	38.7 (545)	40.6 (212)	36.7 (220)
Short higher	8.0 (113)	7.1 (37)	8.8 (53)
Medium higher	20.7 (292)	17.4 (91)	23.3 (140)
Long higher	12.3 (173)	10.0 (52)	14.5 (87)
Household income[a], DKK (%, N), N=1298			
<250.000	17.9 (232)	24.2 (115)	15.4 (86)
250.000-399.999	19.5 (253)	21.5 (102)	18.9 (105)
400.000-599.999	21.1 (274)	22.3 (106)	19.2 (107)
600.000-799.999	21.7 (282)	15.4 (73)	24.4 (136)
≥800.000	19.8 (257)	16.6 (79)	22.1 (123)
Health behaviour			
Steps/day (mean, SD)	8367 (3482)	5285 (1705)	11126 (3043)
Cycling in steps/day (mean, SD)	1322 (2278)	264 (675)	2522 (2917)
Steps/day incl. cycling (mean, SD)	9689 (4352)	5549 (1696)	13648 (3296)
Steps/day incl. cycling, categorical (%, N)			
<8,000 steps/day incl. cycling (%, N)	37.1 (526)	100 (526)	-
8,000-9,999 steps/day incl. cycling (%, N)	20.2 (287)	-	-
≥10,000 steps/day incl. cycling (%, N)	42.7 (605)	-	100 (605)
Self-assessed PA level, leisure time (%, N), N=1406			

Vigorous	5.7 (80)	3.3 (17)	8.2 (49)
Moderate	34.4 (483)	24.0 (125)	42.7 (256)
Light	53.5 (752)	61.2 (319)	46.8 (281)
Sedentary	6.5 (91)	11.5 (60)	2.3 (14)
Self-assessed diet healthiness (%, N), N=1417			
High degree	24.4 (346)	22.7 (119)	27.6 (167)
Some degree	51.5 (730)	45.9 (241)	53.9 (326)
Partly/Not at all	24.1 (341)	31.4 (165)	18.5 (112)
Smoking behaviour (%, N), N=1406	20.8 (293)	26.3 (137)	16.2 (97)
Slimming diet (%, N), N=1407			
No	58.6 (825)	54.2 (283)	63.3 (380)
Yes, now	6.3 (89)	8.0 (42)	4.7 (28)
Yes, within the last year	11.0 (155)	11.1 (58)	10.0 (60)
Yes, more than one year ago	24.0 (338)	26.6 (139)	22.0 (132)
Health			
Weight status (%, N), N=1348			
Normal weight (BMI <25)	42.9 (578)	28.8 (141)	54.8 (322)
Overweight (BMI 25 - <30)	40.5 (546)	46.7 (229)	35.5 (209)
Obese (BMI ≥30)	16.6 (224)	24.5 (120)	9.7 (57)
Abdominal weight status (%, N), N=1333			
Healthy[b]	41.8 (557)	25.9 (125)	55.4 (321)
Abdominal overweight[c]	26.3 (350)	26.3 (127)	25.6 (148)
Abdominal obesity[d]	32.0 (426)	47.8 (231)	19.0 (110)
Elevated cholesterol, N=1410	12.4 (175)	18.7 (98)	7.5 (45)
Self-rated health (%, N), N=1407			
Excellent	23.8 (335)	17.4 (91)	28.5 (171)
Very good	38.7 (545)	33.1 (173)	43.5 (261)
Good	30.1 (424)	37.0 (193)	24.8 (149)
Fair/poor	7.3 (103)	12.5 (65)	3.2 (19)

[a] 7.45 Danish kroner = 1 Euro
[b] Men: <94 cm; women: <80 cm
[c] Men: 94-101 cm; women: 80-87 cm
[d] Men: ≥102 cm; women: ≥88 cm

3.1.2 Pedometer-determined physical activity among Danish adults

Danish adults took on average 9521 steps/day (Table 7). The proportion of adults taking less than 8,000 steps/day was 39 %, while 20 % took 8,000-9999 steps/day, and 41 % took at least 10,000 steps/day. There were no significant gender differences.

Table 7. Pedometer-determined physical activity (incl. cycling) in the Danish adult population (N=1418)

	All	Men	Women	P-value*
Steps/day (mean, SD)	9521 (4391)	9710 (4336)	9329 (4441)	0.102
<8,000 steps/day (%)	39	37	41	0.168
8,000-9999 steps/day (%)	20	20	21	0.240
≥10,000 steps/day (%)	41	43	39	0.104

* Gender differences. Tested using Chi-square test for categorical variables and ANOVA test for continuous variables (P<0.05)

3.1.3 Self-assessed physical activity among Danish adults

Among Danish adults, 6 % assessed their leisure time activity level as vigorous and 33 % as moderate, while 54 % assessed their activity as light and 7 % as sedentary (Table 8). More men assessed their leisure time activity as vigorous or moderate, and more women assessed their activity as light.

Table 8. Self-assessed physical activity during leisure time in the Danish adult population. Percentages (N=1406)

	All	Men	Women	P-value*
				<0.001
Vigorous	6	8	4	
Moderate	33	37	28	
Light	54	47	61	
Sedentary	7	8	6	

* Gender differences. Tested using Chi-square test (P<0.05)

3.2 Extent of optimistic and pessimistic self-assessments of physical activity

Among adults taking less than 8,000 steps/day (39 %), 27 % assessed their activity as moderate or vigorous (Table 9) and were defined as being optimistic in their self-assessment. Seventy three percent were realistic about being inactive. Compared with women, more men were optimistic in assessing their physical activity level (32 % vs 22 %, P=0.010). Among adults taking at least 10,000 steps/day (41 %), 50 % assessed their activity level as being light or sedentary and were defined as being pessimistic in their self-assessment. Fifty percent were realistic about being active. Compared with men, more women were pessimistic in assessing their physical activity level (56 % vs 45 %, P=0.013). The sensitivity analyses with cut-off points plus/minus 500 steps/day did not affect the proportions significantly (data not shown).

Table 9. Optimistic and realistic self-assessment among inactive adults and pessimistic and realistic self-assessment among active adults. Percentages

	All	Men	Women	P-value*
Inactive (n=526)				0.010
Optimistic assessors	27	32	22	
Realistic assessors	73	68	78	
Active (n=605)				0.013
Pessimistic assessors	50	45	56	
Realistic assessors	50	55	44	

* Gender differences. Tested using Chi-square test (P<0.05)

Among all adults, the proportion of optimistic assessors was 11 % (Figure 4), while 29 % were realistic about being inactive. The proportion of pessimistic assessors among all adults was 21 %, while 20 % were realistic about being active.

		Lay people's self-assessed physical activity level	
		Moderate/vigorous	Light/sedentary
A health professional assessment of physical activity	<8,000 steps/day	Optimistic assessors 11 %	Realistic assessors 29 %
	8,000-9999 steps/day	8 %	12 %
	≥10,000 steps/day	Realistic assessors 20 %	Pessimistic assessors 21 %

Figure 4. Proportions of optimistic, realistic and pessimistic assessors of physical activity among Danish adults (N=1406)

3.3 Factors associated with optimistic and pessimistic self-assessment physical activity

Among adults taking less than 8,000 steps/day, optimistic self-assessment of physical activity was associated with gender and self-rated health and borderline significantly associated with abdominal weight status (Table 10). Men were more likely to be optimistic about their physical activity level than women, and adults with excellent self-rated health were more likely to be optimistic assessors compared to adults with good or fair/poor self-rated health. The borderline significant association with abdominal weight status indicates that adults with a healthy abdominal weight status were more likely to be optimistic assessors than abdominal obese adults. None of the tested interactions between the explanatory variables proved to be statistically significant.

Table 10. Odds Ratios (OR, 95 % CI) for optimistic self-assessment of physical activity level among inactive participants (<8,000 steps/day incl. cycling[a]) (outcome variable: optimistic vs realistic assessors) (N=517[b])

		OR	95 % CI	P-value[c]
Gender				
	Men	1.00		
	Women	**0.45**	**0.29-0.68**	**<0.001**
Self-rated health				**<0.001**
	Excellent	1.00		
	Very good	0.66	0.38-1.14	0.134
	Good	**0.36**	**0.20-0.64**	**<0.001**
	Fair/poor	**0.15**	**0.06-0.38**	**<0.001**
Abdominal weight status				0.059
	Healthy	1.00		
	Abdominal overweight	0.58	0.32-1.04	0.066
	Abdominal obesity	**0.52**	**0.32-0.92**	**0.023**

[a] Included factors: gender, age, educational level, household income, weight status, abdominal weight status, elevated cholesterol, self-rated health, slimming diet, self-assessed diet healthiness, smoking behaviour. Gender, age and education were kept in the model

[b] Optimistic assessors n=142, realistic assessors n=379, missing data n=4

[c] Tested using multiple logistic regression (P<0.05)

Among adults taking at least 10,000 steps/day, pessimistic self-assessment of physical activity level was associated with gender, age and education, household income, self-rated health and self-assessed diet healthiness (Table 11). Women were more likely to be pessimistic about their physical activity than men, and 45-64-year-olds were more likely to be pessimistic assessors than 18-44-year-olds. Adults with basic education were more likely to be pessimistic assessors compared to adults with medium higher education, and adults with a household income below 250.000 DKK were more likely to be pessimistic assessors than adults with a household income of at least 800.000 DKK. Furthermore, adults with good or very good self-rated health were more like to be pessimistic about their physical activity than adults with excellent self-rated

health. Also adults who considered their diets not to be healthy enough were more likely to be pessimistic assessors than adults considering their diets to be healthy enough to a high degree. None of the tested interactions between the explanatory variables proved to be statistically significant.

Table 11. Odds Ratios (OR, 95 % CI) for pessimistic self-assessment of physical activity among active participants (≥10,000 steps/day incl. cycling[a]) (outcome variable: pessimistic vs realistic assessors) (N=554[b])

		OR	95 % CI	P-value[c]
Gender				
	Men	1.00		
	Women	**2.10**	**1.44-3.06**	**<0.001**
Age				**0.008**
	18-24	**0.37**	**0.17-0.83**	**0.016**
	25-44	**0.52**	**0.34-0.79**	**0.002**
	45-64	1.00		
	65-75	0.71	0.36-1.41	0.330
Education				**0.003**
	Basic school	1.00		
	Upper secondary school	0.38	0.14-1.03	0.057
	Vocational	0.91	0.41-2.00	0.808
	Short higher	0.77	0.30-2.00	0.595
	Medium higher	**0.40**	**0.17-0.92**	**0.031**
	Long higher	1.12	0.46-2.72	0.809
Household income (DDK)				**0.035**
	<250.000	1.00		
	250.000-399.999	0.74	0.39-1.42	0.361
	400.000-599.999	0.58	0.30-1.14	0.113
	600.000-799.999	0.60	0.31-1.15	0.121
	≥800.000	**0.34**	**0.17-0.68**	**0.002**
Self-rated health				**0.002**
	Excellent	1.00		
	Very good	**1.91**	**1.22-2.98**	**0.005**
	Good	**2.59**	**1.55-4.33**	**<0.001**
	Fair/poor	2.84	0.91-8.88	0.074
Self-assessed diet healthiness				**0.002**
	High degree	1.00		
	Some degree	0.96	0.62-1.48	0.855
	Partly/Not at all	**2.37**	**1.33-4.24**	**0.004**

[a] Included factors: gender, age, educational level, household income, weight status, abdominal weight status, elevated cholesterol, self-rated health, slimming diet, self-assessed diet healthiness, smoking behaviour. Gender, age and education were kept in the model

[b] Pessimistic assessors n=295, realistic assessors n=305, missing data n=46

[c] Tested using multiple logistic regression (P<0.05)

3.4 Estimated diet quality versus self-assessed diet healthiness

3.4.1 Study population

In DANSDA 2011-2013 valid dietary intake data were available from 3014 adults aged 18-75 years. This corresponds to a response rate of 52 %. The gender distribution was 49 % men and 51 % women, and the mean age was 48 years among men and 47 years among women. Thirty nine percent reported having completed a short, medium or long higher education. Study sample characteristics are shown in Table 12a. Among adults with unhealthy diets, there were a higher number of men and younger adults, lower educated and adults with unfavourable health and behavioural characteristic compared to the total sample. Among adults with healthy diets, there were a higher number of women and older adults, higher educated and adults with favourable health and behavioural characteristics compared to the total sample (Table 12b).

Table 12a. Study sample characteristics in the study of diet healthiness

	All N=3014	Men N=1464	Women N=1550	P-value[a]
Socio-demography				
Gender (%, N)				0,122
Men	48.6 (1464)	-	-	
Women	51.4 (1550)	-	-	
Age groups, years (%, N)				0.873
18-24	11.4 (345)	11.6 (170)	11.3 (175)	
25-44	30.4 (917)	30.3 (443)	30.6 (474)	
45-64	40.7 (1228)	40.2 (589)	41.2 (639)	
65-75	17.4 (524)	17.9 (262)	16.9 (262)	
Age, years (mean, SD)	47.5 (16.0)	47.5 (16.2)	47.4 (15.8)	0.932
Educational level (%, N), N=2988				<0.001
Elementary school	14.2 (423)	14.0 (204)	14.3 (219)	
Upper secondary school	7.9 (235)	7.3 (106)	8.4 (129)	
Vocational training	38.6 (1154)	42.5 (618)	34.9 (536)	
Short higher education	7.3 (219)	7.7 (112)	7.0 (107)	
Medium higher education	20.1 (601)	15.1 (220)	24.8 (381)	
Long higher education	11.9 (356)	13.3 (193)	10.6 (163)	
Household income[b], DDK (%, N), N=2767				0.042
<250.000	18.3 (507)	16.8 (232)	19.9 (275)	
250.000-399.999	18.6 (516)	17.9 (248)	19.4 (268)	
400.000-599.999	21.7 (601)	21.3 (295)	22.1 (306)	
600.000-799.999	21.5 (595)	22.7 (315)	20.3 (280)	
≥800.000	19.8 (548)	21.3 (295)	18.3 (253)	
Health behaviour				
Diet index score (mean, SD)	3.3 (0.9)	3.2 (0.9)	3.5 (0.8)	<0.001
Diet index, categorical (%, N), N=3014				<0.001
Low	33.3 (1005)	41.9 (614)	25.2 (391)	
Intermediate	33.3 (1005)	33.3 (488)	33.4 (517)	
High	33.3 (1004)	24.7 (362)	41.4 (642)	
Self-assessed diet healthiness (%, N), N=3012				0.040
Yes, to a high degree	25.2 (759)	25.1 (367)	25.3 (392)	
Yes, to some degree	50.5 (1522)	48.7 (713)	52.3 (809)	
No, only partly/not at all	24.3 (731)	26.2 (384)	22.4 (347)	
Smoking behaviour (%, N), N=2993	20.8 (623)	23.5 (342)	18.3 (281)	<0.001
Self-assessed PA level, leisure time (%, N), N=2992				
Vigorous	5.9 (177)	8.3 (121)	3.6 (56)	<0.001
Moderate	32.3 (967)	37.3 (542)	27.6 (425)	
Light	54.4 (1628)	46.5 (675)	61.9 (953)	
Sedentary	7.4 (220)	7.9 (114)	6.9 (106)	
Slimming diet (%, N), N=2993				<0.001
No	60.3 (1805)	74.7 (1086)	46.7 (719)	
Yes, now	6.0 (180)	3.9 (57)	8.0 (123)	
Yes, within the last year	10.2 (304)	7.1 (103)	13.1 (201)	
Yes, more than one year ago	23.5 (704)	14.3 (208)	32.2 (496)	

Health					
Weight status (%, N), N=2719					<0.001
	Normal weight (BMI <25)	43.4 (1181)	36.5 (489)	50.2 (692)	
	Overweight (BMI 25 - <30)	39.2 (1067)	44.4 (595)	34.3 (472)	
	Obese (BMI ≥30)	17.3 (471)	19.2 (257)	15.5 (214)	
Abdominal weight status (%, N), N=2717					<0.001
	Healthy[a]	41.8 (1137)	46.5 (626)	37.2 (511)	
	Abdominal overweight[b]	25.6 (696)	25.7 (345)	25.6 (351)	
	Abdominal obesity[c]	32.5 (884)	27.8 (374)	37.2 (510)	
Elevated cholesterol, N=3001		12.7 (382)	12.0 (175)	13.4 (207)	0.275
Self-rated health (%, N), N=2994					0.159
	Excellent	24.1 (722)	25.2 (366)	23.1 (356)	
	Very good	37.6 (1127)	36.7 (534)	38.5 (593)	
	Good	30.0 (898)	30.7 (447)	29.3 (451)	
	Fair/poor	8.2 (247)	7.4 (107)	9.1 (140)	

[a] Gender differences. Tested using Chi-square test for categorical variables and ANOVA test for continuous variables (P<0.05)

[b] 7.45 Danish kroner = 1 Euro

[c] Men: <94 cm; women: <80 cm

[d] Men: 94-101 cm; women: 80-87 cm

[e] Men: ≥102 cm; women: ≥ 88 cm

Table 12b. Characteristics of participants with unhealthy diets (diet index score <3.0) and healthy diets (diet index score ≥3.8)

	All N=3014	Unhealthy diets N=1005	Healthy diets N=1004
Socio-demography			
Gender (%, N)			
Men	48.6 (1464)	61.1 (614)	36.1 (362)
Women	51.4 (1550)	38.9 (391)	63.9 (642)
Age groups, years (%, N)			
18-24	11.4 (345)	15.8 (159)	9.2 (92)
25-44	30.4 (917)	35.2 (354)	25.7 (258)
45-64	40.7 (1228)	36.3 (365)	44.6 (448)
65-75	17.4 (524)	12.6 (127)	20.5 (206)
Age, years (mean, SD)	47.5 (16.0)	44.1 (16.2)	49.9 (15.6)
Educational level (%, N), N=2988			
Elementary school	14.2 (423)	19.6 (195)	9.9 (99)
Upper secondary school	7.9 (235)	9.4 (93)	7.1 (71)
Vocational training	38.6 (1154)	43.7 (434)	33.9 (338)
Short higher education	7.3 (219)	6.5 (65)	7.7 (77)
Medium higher education	20.1 (601)	13.8 (137)	25.7 (256)
Long higher education	11.9 (356)	6.9 (69)	15.7 (157)
Household income[a], DDK (%, N), N=2767			
<250.000	18.3 (507)	22.1 (202)	15.8 (145)
250.000-399.999	18.6 (516)	19.7 (180)	17.9 (164)
400.000-599.999	21.7 (601)	22.5 (206)	20.3 (186)
600.000-799.999	21.5 (595)	21.5 (197)	20.9 (191)
≥800.000	19.8 (548)	14.3 (131)	25.1 (230)
Health behaviour			
Diet index score (mean, SD)	3.3 (0.9)	2.4 (0.5)	4,3 (0.3)
Diet index, categorical (%, N), N=3014			
Low (unhealthy diets)	33.3 (1005)	100 (1005)	-
Intermediate (somewhat healthy diets)	33.3 (1005)	-	-
High (Healthy diets)	33.3 (1004)	-	100 (1004)
Self-assessed diet healthiness (%, N), N=3012			
Yes, to a high degree	25.2 (759)	15.0 (151)	35.7 (358)
Yes, to some degree	50.5 (1522)	44.5 (447)	51.9 (521)
No, only partly/not at all	24.3 (731)	40.4 (406)	12.4 (124)
Smoking behaviour (%, N), N=2993	20.8 (623)	34.2 (340)	11.5 (115)
Self-assessed PA level, leisure time (%, N), N=2992			
Vigorous	5.9 (177)	5.7 (57)	4.7 (47)
Moderate	32.3 (967)	27.1 (269)	35.9 (358)
Light	54.4 (1628)	53.9 (535)	55.4 (552)
Sedentary	7.4 (220)	13.3 (132)	4.0 (40)
Slimming diet (%, N), N=2993			
No	60.3 (1805)	63.3 (630)	57.7 (575)
Yes, now	6.0 (180)	4.4 (44)	6.9 (69)
Yes, within the last year	10.2 (304)	9.9 (99)	10.5 (105)

	Yes, more than one year ago	23.5 (704)	22.3 (222)	24.8 (247)
Health				
Weight status (%, N), N=2719				
	Normal weight (BMI <25)	43.4 (1181)	39.0 (355)	47.6 (429)
	Overweight (BMI 25 - <30)	39.2 (1067)	39.0 (355)	38.6 (348)
	Obese (BMI ≥30)	17.3 (471)	22.0 (200)	13.8 (124)
Abdominal weight status (%, N), N=2717				
	Healthy[b]	41.8 (1137)	39.3 (353)	44.2 (398)
	Abdominal overweight[c]	25.6 (696)	25.5 (229)	25.1 (226)
	Abdominal obesity[d]	32.5 (884)	35.2 (316)	30.7 (277)
Elevated cholesterol, N=3001		12.7 (382)	9.6 (96)	15.4 (154)
Self-rated health (%, N), N=2994				
	Excellent	24.1 (722)	21.4 (213)	27.5 (274)
	Very good	37.6 (1127)	33.9 (337)	39.6 (395)
	Good	30.0 (898)	33.5 (333)	27.2 (271)
	Fair/poor	8.2 (247)	11.3 (112)	5.7 (57)

[a] 7.45 Danish kroner = 1 Euro

[b] Men: <94 cm; women: <80 cm

[c] Men: 94-101 cm; women: 80-87 cm

[d] Men: ≥102 cm; women: ≥88 cm

3.4.2 Estimated diet quality among Danish adults

Diet quality distribution in the adult population is illustrated in Figure 5. Less than 1 % had a diet index score of 5, which means that less than 1 % complied with the five guidelines from Danish FBDG included in the diet index: saturated fat, added sugar, fruits and vegetables, fish, and wholegrain. Half of the adult population had a diet index score of 3.3 or lower, and the mean diet index score was 3.2 (Table 13).

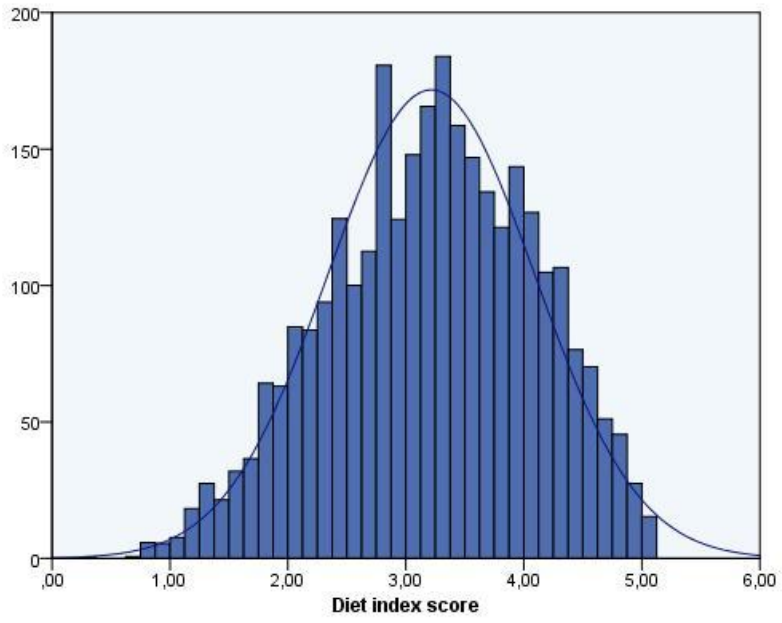

Figure 5. Distribution of the diet index score among Danish adults (N=3014)

Table 13. Diet index score among Danish adults (mean, median, SD, minimum and maximum) (N=3014)

	Mean	Median	SD	Min – Max	P-value*
					<0.001
All	3.2	3.3	0.9	0.3-5.0	
Men	3.0	3.0	0.9	0.3-5.0	
Women	3.4	3.5	0.8	0.8-5.0	

*Gender differences. Tested using ANOVA test (P<0.05)

As evident in table 14, a low diet index score corresponds to score between 0.3 and 3.0 – defined as unhealthy diets. A high diet index score corresponds to a score between 3.8 and 5.0 – defined as healthy diets.

Table 14. Diet index score among Danish adults with a low, intermediate and high diet index score (mean, median, SD, minimum and maximum) (N=3014)

Diet index score	Mean	Median	SD	Min – Max	P-value*
					<0.001
Low	2.3	2.4	0.5	0.3-3.0	
Intermediate	3.4	3.4	0.2	3.0-3.8	
High	4.3	4.2	0.3	3.8-5.0	

* Differences between diet index tertiles. Tested using ANOVA test (P<0.05)

The diet index was estimated on the basis of unweighted data. Accordingly, so was the estimation of tertiles of low, intermediate and high diet index scores. Table 15 shows the proportion of adults with low, intermediate and high diet index score, when data are weighted according to the Danish adult population on gender, age and education. The proportion of adults with a low diet index score was 40 %, 32 % had an intermediate diet index score, while 28 % had a high diet index score. More men had a low diet index score, while more women had a high diet index score.

Table 15. Low, intermediate and high diet index score among Danish adults. Percentages. (N=3014)

	All	Men	Women	P-value*
				P<0.001
Low	40	51	30	
Intermediate	32	30	35	
High	28	19	36	

*Gender differences. Tested using Chi-square test (P<0.05)

Table 16 shows the proportion of non-compliance with each of the five food and nutrient guidelines included in the diet index among Danish adults. As evident, the majority of Danish adults did not comply with the five guidelines: 97 % did not comply with the guideline for

saturated fat, three out of four did not comply with the guidelines for fruits and vegetables, wholegrain and fish, and 37 % did not comply with the guideline for added sugar.

Table 16. Non-compliance of the five food and nutrient guidelines included in the diet index among Danish adults. Percentages (N=3014)

Food and nutrient guidelines included in the diet index	Non-compliance (%)
Fruit & vegetables (600 g/10 MJ/day)	78
Wholegrain (≥75 g/10 MJ/day)	75
Fish (50 g/10 MJ/day)	74
Saturated fat (≤10 E%)	97
Added sugar (≤10 E%)	37

Table 17 shows the content of the foods and nutrients included in the diet index of participants with a low, intermediate and high diet index score. Data show that the diets of participants with a low diet index score – as compared with FBDG – on average contain a low amount of fruit and vegetables, wholegrain and fish and a high amount of saturated fat and added sugar. On the contrary, the average diets of participants with a high diet index score contain a high amount of fruit and vegetables, wholegrain and fish and a low amount of added sugar compared to recommendations in FBDG. The amount of saturated fat in the diets of participants with a high diet index score is also high, however lower than the amount of saturated fat in the diets of participants with a low diet index score.

Table 17. Mean intake of the five food and nutrients included in the diet index among Danish adults with low, intermediate and high diet index score (N=3014)

	Fruit & vegetables (g/10MJ/day)	Wholegrain (g/10MJ/day)	Fish (g/10MJ/day)	Saturated fat (E%)	Added sugar (E%)
Low	282	43	16	17	12
Intermediate	463	62	33	15	8
High	633	79	63	13	6
P-value	<0.001	<0.001	<0.001	<0.001	<0.001

3.4.3 Self-assessed diet healthiness among Danish adults

When adults were asked to assess the healthiness of their own diets, 71 % assessed it as healthy enough – 22 % “to a high degree” and 49 % “to some degree”. Thirty percent assessed their diets as not healthy enough – 24 % as “no, only partly” and 5 % as “no, not at all” (Table 18). More men than women were categorized as “no, not at all” (7 % vs 4 %, P<0.001).

Table 18. Self-assessment of diet healthiness among Danish adults. Percentages (N=3012)

	All	Men	Women	P-value*
				P<0.001
Yes, to a high degree	22	21	23	
Yes, to some degree	49	46	51	
No, only partly	24	26	23	
No, not at all	5	7	4	

*Gender differences. Tested using Chi-square test (P<0.05)

3.5 Extent of optimistic and pessimistic self-assessments of diet healthiness

Among Danish adults with unhealthy diets (40 %), 55 % assessed their diets to be healthy enough – 13 % to a high degree (highly optimistic) and 42 % to some degree (somewhat optimistic) (Table 19). Forty five percent were realistic about their unhealthy diets. Compared to women, more men were highly optimistic when assessing the healthiness of their diets (15 % vs 9 %, P=0.003). Among Danish adults with healthy diets (28 %), 65 % assessed their diets not to be healthy enough – 14% assessed their diets as not at all healthy enough (highly pessimistic), while 51 % assessed their diets as only partly healthy enough (somewhat pessimistic). Thirty five percent were realistic about their healthy diets. No significant gender difference in pessimistic self-assessment was found. The sensitivity analyses with different cut-off points (quartiles) did not change the proportion of optimistic and pessimistic self-assessments significantly (data not shown).

Table 19. Optimistic and realistic self-assessment among adults with unhealthy diets (diet index score <3.0) and pessimistic and realistic self-assessment among adults with healthy diets (diet index score ≥3.8). Percentages

	All	Men	Women	P-value*
Unhealthy diets (n=1005)				0.003
Highly optimistic assessors	13	15	9	
Somewhat optimistic assessors	42	41	44	
Realistic assessors	45	44	47	
Healthy diets (n=1004)				0.156
Highly pessimistic assessors	14	18	13	
Somewhat pessimistic assessors	51	48	52	
Realistic assessors	35	34	35	

* Gender differences. Tested using Chi-square test (P<0.05)

Among all adults, 29 % were optimistic about the healthiness of their diets (5+17+7; Figure 6) and 26 % were pessimistic (8+14+4). The proportion of realistic assessors was 46 % (18+18+10).

		Lay people's self-assessed diet healthiness		
		To a high degree healthy	To some degree healthy	Partly/not at all healthy
A health professional assessment of diet quality	Unhealthy diets	Highly optimistic assessors 5 %	Somewhat optimistic assessors 17 %	Realistic assessors 18 %
	Somewhat healthy diets	Somewhat optimistic assessors 7 %	Realistic assessors 18 %	Somewhat pessimistic assessors 8 %
	Healthy diets	Realistic assessors 10 %	Somewhat pessimistic assessors 14 %	Highly pessimistic assessors 4 %

Figure 6. Proportions of optimistic, realistic and pessimistic assessors of diet healthiness among Danish adults (N=3012)

3.6 Factors associated with optimistic and pessimistic self-assessment of diet healthiness

Among adults with unhealthy diets, highly optimistic self-assessment of diet healthiness was associated with age, self-rated health, weight status and leisure time physical activity (Table 20). Adults aged 65-75 years were more likely to be optimistic about the healthiness of their diets than 45-65-year-olds, while 18-44-year-olds were less likely be optimistic about the healthiness of their diets. Furthermore, adults with excellent self-rated health were more likely to be optimistic assessors than adults with good or very good self-rated health, and normal weight adults were more likely to be optimistic assessors than overweight or obese adults. Finally, adults with a moderate physical activity level were more likely to be optimistic assessors than adults with a light or a sedentary physical activity level. None of the tested interactions between the explanatory variables proved to be statistically significant.

In the sensitivity analysis of factors associated with somewhat and highly optimistic self-assessment of diet healthiness, the overall findings were the same (data not shown). However, self-rated health was no longer significantly associated with optimistic self-assessment.

Table 20. Odds Ratios (OR, 95 % CI) for highly optimistic self-assessment of diet healthiness among participants with unhealthy diets[a] (diet index score <3.0) (outcome variable: highly optimistic vs realistic assessors) (N=497[b])

		OR	95 % CI	P-value[c]
Age				**<0.001**
	18-24	**0.05**	**0.02-0.15**	**<0.001**
	25-44	**0.14**	**0.07-0.27**	**<0.001**
	45-64	1.00		
	65-75	**2.84**	**1.42-5.69**	**0.003**
Self-rated health				**0.004**
	Excellent	1.00		
	Very good	**0.36**	**0.19-0.69**	**0.002**
	Good	**0.34**	**0.17-0.65**	**0.001**
	Fair/poor	0.56	0.24-1.30	0.177
Weight status				**<0.001**
	Normal weight[d] (BMI <25)	1.00		
	Overweight (BMI 25 - <30)	**0.40**	**0.23-0.71**	**0.002**
	Obese (BMI ≥30)	**0.11**	**0.05-0.24**	**<0.001**
Physical activity, leisure time				**0.037**
	Vigorous	0.49	0.14-1.78	0.281
	Moderate	1.00		
	Light	**0.48**	**0.27-0.85**	**0.011**
	Sedentary	**0.36**	**0.15-0.83**	**0.017**

[a] Included factors: gender, age, educational level, household income, weight status, abdominal weight status, elevated cholesterol, self-rated health, slimming diet, self-assessed leisure time physical activity, smoking behaviour. Gender, age and education were kept in the model

[b] Optimistic assessors n=151, realistic assessors n=406, missing data n=60

[c] Tested using multiple logistic regression (P<0.05)

[d] 1 % was underweight (BMI <18.5)

Among adults with healthy diets, highly pessimistic self-assessment of diet healthiness was associated with age, self-rated health and weight status (Table 21). Furthermore, it was borderline significantly associated with leisure time physical activity. Adults aged 25-44 years were more likely to be pessimistic about the healthiness of their diets than 45-64-year-olds, and 65-75-year-olds were less likely to be pessimistic about the healthiness of their diets. Furthermore, adults with good self-rated health were more likely to be pessimistic assessors than adults with excellent self-rated health, and obese adults were more likely to be pessimistic assessors than normal weight adults. Additionally, the borderline significant association with leisure time physical activity indicated that adults with a sedentary activity level were more likely to be pessimistic assessors than adults with moderate activity level. None of the tested interactions between the explanatory variables proved to be statistically significant.

In the sensitivity analysis of factors associated with somewhat and highly pessimistic self-assessment, the overall findings were the same (data not shown). However, some of the findings were less marked when somewhat pessimistic assessors were included in the outcome. For example Odds Ratio values were typically closer to the reference category than in

the analyses of only highly pessimistic self-assessment. Additionally, slimming diet and leisure time physical activity was significantly associated with pessimistic self-assessment.

Table 21. Odds Ratios (OR, 95 % CI) for highly pessimistic self-assessment of diet healthiness among participants with healthy diets[a] (diet index score ≥3.8) (outcome variable: highly pessimistic vs realistic assessors) (N=424[b])

		OR	95 % CI	P-value[c]
Age				**<0.001**
	18-24	1.40	0.46-4.27	0.557
	25-44	**2.78**	**1.52-5.08**	**0.001**
	45-64	1.00		
	65-75	**0.48**	**0.24-0.95**	**0.035**
Self-rated health				**0.002**
	Excellent	1.00		
	Very good	1.89	0.99-3.60	0.054
	Good	**3.59**	**1.85-6.99**	**<0.001**
	Fair/poor	1.41	0.42-4.71	0.577
Weight status				**0.002**
	Normal weight[d] (BMI <25)	1.00		
	Overweight (BMI 25 - <30)	1.58	0.90-2.77	0.112
	Obese (BMI ≥30)	**3.75**	**1.82-7.73**	**<0.001**
Physical activity, leisure time				0.068
	Vigorous	0.41	0.10-1.65	0.211
	Moderate	1.00		
	Light	1.54	0.89-2.67	0.125
	Sedentary	2.92	0.99-8.66	0.053

[a] Included factors: gender, age, educational level, household income, weight status, abdominal weight status, elevated cholesterol, self-rated health, slimming diet, self-assessed leisure time physical activity, smoking behaviour. Gender, age and education were kept in the model

[b] Pessimistic assessors n=124, realistic assessors n=358, missing data n=58

[c] Tested using multiple logistic regression (P<0.05)

[d] Less than 1 % were underweight (BMI <18.5)

3.7 Summary: factors associated with optimistic and pessimistic self-assessment of diet healthiness and physical activity

Overall, several factors were found to be associated with optimistic and pessimistic self-assessment of diet healthiness and physical activity level. Table 22 gives an overview of the findings, including only the response categories with the highest Odds Ratio values.

The findings of health and health behavioural factors being associated with optimistic and pessimistic self-assessment of diet healthiness and physical activity suggest that favourable health characteristics were associated with optimistic self-assessment, while less favourable health characteristics were associated pessimistic self-assessment.

With regard to socio-demography, men were more likely to be optimistic about their physical activity level, while women were more likely to be pessimistic. No gender difference was found for optimistic and pessimistic self-assessment of diet healthiness. Older adults were more likely to be optimistic about the healthiness of their diets, while younger adults were more pessimistic. This age trend was not found for physical activity, where middle-aged adults were found to be more likely to be pessimistic about their physical activity level than younger adults. Additionally, adults with basic education and with a household income less than 250,000 DKK were more likely to be pessimistic about their physical activity level than adults with medium higher education and a household income of at least 800,000 DKK, respectively.

Table 22. Overview of factors[a] associated with optimistic and pessimistic self-assessment of diet healthiness and physical activity

	Optimistic self-assessment	Pessimistic self-assessment
Diet healthiness	Excellent self-rated health	Good self-rated health
	Normal weight	Obese
	Moderate physical activity level	-
	65-75-year-olds	25-44-year-olds
Physical activity level	Excellent self-rated health	Good self-rated health
	-	-
	-	Partly/not at all healthy diets (self-assessed)
	Men	Women
	-	45-64-year-olds
	-	Basic education
	-	Income <250.000 DKK

[a] Only response categories with the highest OR are included

3.8 Criteria in lay people's self-assessments of unhealthy diets

> "So long as I'm not up to 120 kg – if I was, then of course I'd probably have changed my eating habits. But I'm around the 100 mark, and I'm fine with that… Because I can do my job, and if some take the elevator up to the seventh floor, well then – if there isn't room – I can take the stairs. It doesn't bother me at all… And if we're going down, well then I can run down too without any bother at all. So long as I can do that, then I don't think I'm unhealthy or anything like that." (John, optimistic assessor)

The citation above illustrates one of the main findings in the qualitative study – that weight status was found to be a decisive criterion in lay people's diet health assessments. John was in general satisfied with the healthiness of his diet, and his main argument was that he did not weigh too much to do what was important to him. Like that, his weight was a direct indicator of eating healthy enough. Defined on the basis of body mass index, John would be characterized as overweight, and the citation underlines the tendency among interviewees to use personal perceptions of weighing to much rather than biomedical standards. The citation also illustrates another common pattern in the interviews that interviewees only talked about changing their diets if it was related to a desire to lose weight.

Weight status was a dominant topic throughout the interviews, and it was in relation to this theme a convincing difference between optimistic and realistic assessors was found. Regardless of actual weight status, none of the optimistic assessors perceived themselves as overweight; nor had they, except for one, ever had a focus on losing weight. John, cited above, is an example of this. On the contrary, all the realistic assessors were to some extent aware of their weight status; either because of present overweight, because of experiences with gaining and/or losing weight or because of concerns about gaining weight. Thus, it was not only weight status in itself but also weight concerns that were found to play an important role in the assessment of diet healthiness. Overall, overweight or weight gain seemed to be apparent signs of unhealthy eating, while normal weight seemed to be a sign of eating healthy enough. In addition, several of the realistic assessors defined healthy and unhealthy foods on the basis of what they had experienced as food with a slimming effect, or on the contrary, as food that was fattening.

Another main finding in the qualitative study was the decisive role of wellbeing in interviewees' self-assessment of eating healthy enough. The following citation illustrates this point:

> "I'm well, and I don't feel tired or out of sorts or anything like that. I can keep going at work for 9 hours without being tired, without thinking, you know, Holy

> Moly! So, one way or another I'd say one's body is saying: it's okay. It's okay, I'm fine. To my way of thinking, that's what is most important – that one has the energy to do the things one wants to do." (Katrine, realistic assessor)

Throughout the interview, Katrine did not hesitate to articulate her dietary habits as not healthy. She explained that for certain periods she ate quite unhealthy: "So, I know well there are times when – if my doctor showed up and saw what I was eating – my doctor would say to me: are you out of your mind? You're on the road to a heart attack and all kinds of other things!". In these periods she would characterize her dietary habits as "only partly healthy enough". In other periods, she ate healthier and would characterize her diets "to some degree healthy enough" – even though she was well aware that they were not healthy "if you ask a dietitian" as she pointed it. However, overall and without thinking about categories, she considered her dietary habits to be healthy enough, because she felt good. Thus, dietary habits could be assessed as not exactly healthy, but nonetheless healthy enough – if interviewees felt good. This point was underlined by two interviewees with elevated cholesterol and hypertension. Because they did not feel bad because of it, they did not see any or enough reasons for eating a healthier diet. Other symptoms of diseases such as arthritis and chronic obstructive pulmonary disease were mentioned throughout the interviews but it was not part of the interviewees' diet health assessments. Wellbeing was only used positively and as a justification for eating healthy enough, and it seemed like feeling good functioned as a decisive indication of eating healthy enough.

Interviewees were also found to assess the healthiness of their diets on the basis of a bodily feeling. Some interviewees explained how their body sometimes craved for some specific foods, and this craving was perceived as a bodily sign of what the body needed. One interviewee expressed it as follows:

> "I've noticed sometimes that it's related to one's body too… sometimes I feel, like I have this crazy need for one thing or another. I can feel that. Then I have to have some vegetables – broccoli or some other thing. I just have to have it. It's as though one has a deficit of something or other. That's the way I am sometimes.
>
> *Okay – it sounds almost as though it's a physical feeling?*
>
> Oh, it is! The way it is… I don't know what it is exactly, but out of the blue I just get the feeling that there's a need for one thing or another. I've had that experience many times." (Karen, optimistic assessor)

Karen expressed a general satisfaction with the healthiness of her dietary habits. She explained that she ate what she liked and what she felt was good instead of trying to comply with dietary guidelines. Thus, her body was a decisive guideline for healthy eating, rather than external dietary guidelines. Among some interviewees a bodily feeling was also used as a guiding principle underpinning intake of unhealthy foods. If intake of for example sugar-rich foods did not make the interviewee feel bad, then it was not considered unhealthy to eat.

The above-mentioned criteria – weight status and weight concerns, wellbeing and a bodily feeling – were found to be decisive in interviewees' diet health assessment. However, other criteria were also found to be part of the self-assessments. Thus, when interviewees were asked to assess the healthiness of their diets they typically referred to specific foods they ate – usually both healthy and unhealthy foods. In general, fruits, vegetables and fish were highlighted as healthy foods while fat- and sugar-rich foods such as cake, candy and fast food were highlighted as unhealthy. Overall, it seemed like the interviewees' assessments of healthy and unhealthy foods in many ways were in line with FBDG. However, only few of the interviewees knew about Danish FBDG. Instead they referred to other guidelines such as "the pyramid" and "the paleo diet", or they referred to "the recommended amount" without being able to specify exactly which recommendations. Furthermore, they also assessed the healthiness of their diets with references to eating practices considered either healthy or unhealthy, for example eating regular meals or eating candy only in weekends. Thus, by referring to healthy and unhealthy foods, eating practices and different guidelines, interviewees' knowledge and perceptions about healthy eating played a role in their diet health assessments. Also comparisons with former dietary habits and other health related behaviours such as smoking and physical activity were part of the self-assessment among some of the interviewees. Thus, the healthiness of present diets was sometimes assessed relative to previous dietary habits and less healthy eating could be compensated by for example being physically active. These themes were not dominant throughout the interviews, buy they illustrate the range of considerations underlying the interviewees' self-assessments.

3.8.1 Potential changes between interviewees' participation in DANSDA 2011-2013 and the qualitative study

None of the interviewees reported any marked changes with regard to their education, work or family since their participation in DANSDA 2011-2013. Few of the interviewees described that their diets and body weight had changed. Three of the four who reported these changes indicated that their diets had become less healthy and that they had gained weight, while one explained that he had begun to eat more healthily and had lost some weight. All four belonged to the group of 'realistic assessors'.

Overall, the identification of optimistic and realistic assessors based on interviewees' diet quality and response to the question "Do you consider your dietary habits to be healthy enough?" was replicated in the present qualitative study. However, the basis on which the two groups had been distinguished became less clear-cut when detailed responses were elicited by means of qualitative interviews. Most of the interviewees answered the question with a pause before saying "I think…", "that depends on…", or "I'm not sure…", and most self-assessments developed in the course of the interview proving to be more complex than indicated by the categorisation applied in DANSDA. Further, when interviewees were shown the pre-defined response categories, many of them placed themselves in between categories or in a category that differed from their categorisation in DANSDA. Seeing the response categories seemed to incline interviewees to select categories in the middle range. Despite this tendency, optimistic assessors were still more optimistic about the healthiness of their diets than realistic assessors.

3.8.2 Summary

When interviewees with unhealthy diets were asked to assess the healthiness of their diets, they referred to healthy and unhealthy foods and eating practices. They also assessed the healthiness with reference to different guidelines. However, although they drew upon their nutritional knowledge and perceptions about healthy eating, these considerations tended to be overruled by more decisive criteria. Figure 7 shows a grading of the criteria included in the self-assessments. First of all, weight status and weight concerns were decisive criteria, and moreover it was the theme where the most convincing difference between optimistic and realistic assessors was found. The findings indicated that optimistic self-assessment seemed to be a consequence of not perceiving oneself as overweight, not having experiences with losing or gaining weight or not being concerned about personal weight status. Wellbeing and a bodily feeling were also decisive criteria. Thus, diets were assessed as being not exactly healthy, but nevertheless healthy enough – so long as interviewees felt good while adhering to their current diet.

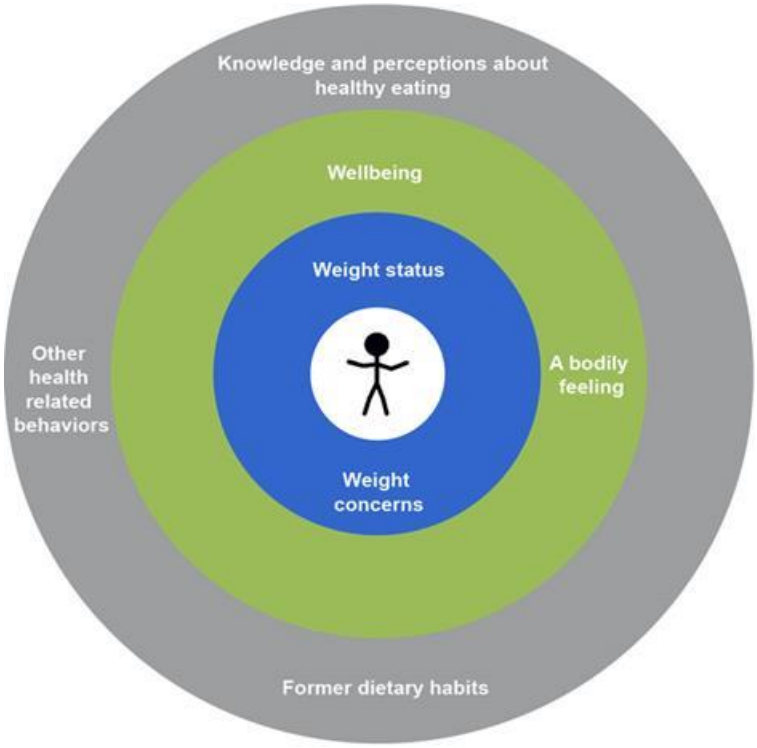

Figure 7. Main findings of the qualitative study: Grading of the criteria underlying lay people's self-assessments of unhealthy diets

4. Discussion

This thesis adds to the knowledge of optimistic self-assessment of diet healthiness by deepen the understanding of the findings derived from the quantitative analyses through qualitative explorations of considerations underlying lay people's self-assessments. Furthermore, the present study is the first to examine optimistic and pessimistic self-assessment of diet healthiness and physical activity in the Nordic countries and to examine this in a large nationally representative sample of the adult population.

4.1 Main findings

One of the key findings of this thesis was that a considerable proportion of adults were found to be optimistic about the healthiness of their diets and their physical activity level, respectively. One fourth of inactive adults and just above half of adults with unhealthy diets were optimistic assessors. Concurrently, three out of four inactive adults and almost half of adults with unhealthy diets were realistic assessors. Furthermore, large proportions of pessimistic assessors were found: Half of active adults and two out of three adults with healthy diets.

Another key finding was the association between health characteristics and optimistic and pessimistic self-assessment of diet healthiness and physical activity. Favourable health characteristics were associated with optimistic self-assessment of diet healthiness and physical activity, while less favourable heath characteristics were associated with pessimistic self-assessment. Different socio-demographic factors were also found to be associated with optimistic and pessimistic self-assessments. Most convincingly, men were more likely to assess their physical activity level optimistically, while women were more likely to assess their physical activity level pessimistically. Furthermore, older adults were more likely to assess the healthiness of their diets optimistically, while younger adults were more likely to assess the healthiness of their diets pessimistically.

A key finding of the qualitative study was that weight status was found to be of vital importance in relation to how the interviewees assessed the healthiness of their own diets, and it was the theme where the most convincing difference between optimistic and realistic assessors was found. Optimistic self-assessments of unhealthy diets seemed to emerge from perceiving oneself as normal weight, not having experiences with weight loss or weight gain or not being concerned about personal weight status. Wellbeing was another decisive criterion when interviewees assessed the healthiness of their diets, and also a bodily feeling turned out as a guiding principle of which foods were healthy or not. Thus, diets might be assessed as not

exactly healthy according to the interviewee's knowledge, but as long as the interviewee felt good, his or her current diet was assessed as healthy enough.

Other criteria, such as knowledge and perceptions about healthy eating, were found to be part of the interviewees' argumentations for and against healthy eating. However, weight status as well as wellbeing and a bodily feeling were found be the most decisive criteria in their self-assessments.

4.2 Integration of quantitative and qualitative findings

4.2.1 Extent of optimistic and pessimistic self-assessments

Compared to the majority of the previous published studies (Brug et al., 1994; Glanz et al., 1997; Godino et al., 2014; Jansink et al., 2012; Lechner et al., 2006, 1997; Ronda et al., 2001; van Sluijs et al., 2007; Variyam et al., 2001; Watkinson et al., 2010) (Table 1 and Table 2), the proportion of optimistic assessors found in this thesis was in the lower end, while the proportion of pessimistic assessors were in the higher end.

Among the populations characterized as physically inactive, the proportion of optimistic assessors in the previously published studies varied between 46 % and 61 %, and among the entire sample it was 16-31 % (Godino et al., 2014; Lechner et al., 2006; Ronda et al., 2001; van Sluijs et al., 2007; Watkinson et al., 2010). The comparable proportions of this thesis were 27 % among inactive and 11 % in the entire sample. In previous studies, the proportion of pessimistic assessors varied between 6 % and 23 %, outlined among the entire sample (Godino et al., 2014; Lechner et al., 2006; Ronda et al., 2001; van Sluijs et al., 2007; Watkinson et al., 2010). In this thesis, the comparable proportion was 21 %. In the studies concerning diet, the results were typically only outlined among the entire sample. The proportions of optimistic self-assessment varied between 27 % and 42 % (Brug et al., 1994; Glanz et al., 1997; Lechner et al., 1997; Variyam et al., 2001) and 2-19 % (Dijkstra et al., 2014), while the proportions of pessimistic self-assessment varied between 20 % and 28 % (Glanz et al., 1997; Variyam et al., 2001) and 1-16 % (Dijkstra et al., 2014). In this thesis, the comparable proportions were 29 % optimistic assessors and 26 % pessimistic assessors.

The different proportions of optimistic and pessimistic assessors across studies may be due to differences in national guidelines or different emphasis on healthy diets and physical activity in different countries and in different periods of times (Glanz et al., 1997; Variyam et al., 2001). It has been argued that people's awareness of their health behaviours most likely increases with health promotion initiatives and with increasing prevalence of obesity (Glanz et al., 1997). Overall, the differences between FBDG in the different countries are minor (Food and

Agriculture Organization of the United Nations, 2016). The studies about optimistic and pessimistic self-assessment of physical activity refer to the physical activity recommendation of being physically active 30 minutes per day or at least five days per week. With regard to overweight and obesity, the prevalence among US adults is about 70 % (U.S. Department of Health and Human Services and U.S. Department of Agriculture, 2015), in UK it is about 65 % (World Health Organization, 2003b), while in Denmark and the Netherlands about half of the adult population are overweight or obese (World Health Organization, 2003b). However, if country specific FBDG and prevalence of overweight and obesity should influence the proportions of optimistic assessors significantly, the proportion would be expected to vary systematically between countries. Such trends cannot be detected from the previous published studies.

Overall, the present study differs from the majority of other studies by analysing a national representative sample of the adult population, while most of the previous studies include samples from local communities (Brug et al., 1994; Glanz et al., 1997; Godino et al., 2014; Ronda et al., 2001; Watkinson et al., 2010), patients with type 2 diabetes or in high risk of type 2 diabetes (Jansink et al., 2012; van Sluijs et al., 2007; Watkinson et al., 2010) or older adults (Dijkstra et al., 2014; Godino et al., 2014). The different proportions of optimistic and pessimistic assessors across studies do not vary systematically with the different study samples and it cannot be concluded that the proportions of optimistic and pessimistic self-assessments depend on the specific population under study. The studies also varied in measures and cut-off points, in definitions of self-assessment groups, and in methods of measurement. It seems likely that the different proportions of optimistic and pessimistic self-assessment may be influenced by methodological differences. Regardless of the differences, the present study and previous published studies form a justification for concluding that a substantial proportion of lay people assess the healthiness of their diets and their physical activity level differently than assessed by health professionals.

Optimistic self-assessment as well as pessimistic self-assessment indicates a difference between assessments of healthy diets and physical activity by health professionals and lay. Studies focus mainly on optimistic self-assessment as this is regarded a potential barrier in the promotion of healthier behaviours. Pessimistic self-assessment is not perceived as a barrier, and pessimistic assessors do already – per definition – have healthy behaviours. In the present study, a rather high proportion was found to be pessimistic about the healthiness of their behaviours. It has previously been emphasized that health professionals should reassure pessimistic assessors “that they are on the right track” (Variyam et al., 2001). The relatively high extent of pessimistic assessors found in the present study substantiate a need to explore this

phenomenon further to better understand what is behind it and what it means in the context of communicating public health recommendations.

It is worth noting that a rather high proportion of lay people seem to be realistic about their unhealthy behaviours. In this thesis, almost half of adults with unhealthy diets were found to be realistic assessors, and three out of four inactive adults were found to be realistic assessors. According to the Precaution Adoption Process Model, awareness of a risk behaviour is emphasized as an important prerequisite for being motivated to change this behaviour (Weinstein, 1988). This has been supported empirically (Brug et al., 1994; Godino et al., 2014; Jansink et al., 2012; Lechner et al., 1997; Ronda et al., 2001; van Sluijs et al., 2007; Variyam et al., 2001). However, several of the interviewees in the qualitative study were aware of their unhealthy diets and did not intend to change their dietary habits as long as they felt good while adhering to their current diet. This finding is supported by other qualitative studies (Beck-Larsen & Kazbare, 2014; Bukman et al., 2014). Those who talked about changing their diets only did so because of a desire to lose weight. Some of the interviewees emphasized that they would never consider eating healthier if they were not overweight or if they did not gain weight. This is an important finding as it underlines that awareness does not necessarily imply a motivation to change behaviour, especially if the unhealthy diet is not accompanied with overweight or weight gain.

4.2.2 Factors associated with optimistic and pessimistic self-assessments

The findings of the present thesis – that favourable health characteristics were associated with optimistic self-assessment of diet healthiness and physical activity, whereas less favourable health characteristics were associated with pessimistic self-assessment – support previous findings (Godino et al., 2014; Lechner et al., 2006; van Sluijs et al., 2007; Variyam et al., 2001; Watkinson et al., 2010). The association may imply that favourable health characteristics function as signs of healthy dietary habits and sufficient physical activity, and the reverse that less favourable health characteristics might function as signs of unhealthy dietary habits and insufficient physical activity. However, this hypothesis has not been further explored so far.

The qualitative study enables an elaboration of the identified factors associated with optimistic self-assessment of unhealthy diets and offers insight into the discussion of what might underlie the association. One of the key findings in the qualitative study was that lay people's weight status seemed to play a decisive role in the self-assessments of unhealthy diets. In line with the findings of the quantitative studies, interviewees in the qualitative study did use their weight status as an indicator of how healthy their diets were, and the qualitative study supports the interpretation that normal weight seems to be perceived by lay people as a sign of eating healthily enough, while overweight seems to be perceived as a sign of the opposite – that what

you eat is not healthy enough. Another qualitative study (Bukman et al., 2014) – aiming at identifying opportunities for lay people to adapt lifestyle interventions – found that interviewees in general relied on feedback from their body, both health/illness and weight, when considering to eat a healthier diet or to become more physical active. The qualitative data of this thesis also indicated that not only present overweight, but also previous experiences with overweight, weight loss, weight gain or weight concerns, played a role in the self-assessment of unhealthy diets. The interviewees that were realistic about their unhealthy diets and normal weight were all somehow concerned about their weight status, had experiences with losing or gaining weight or did not want to gain weight. For this group, healthy eating was to eat as they did when they lost weight, and because they did not eat like that at the time of the interview, they assessed their diets not to be healthy.

The association between self-rated health and highly optimistic self-assessment of diet healthiness found in the quantitative studies is elaborated but only partly clarified by the qualitative findings. In the qualitative study, interviewees talked about different diseases and health problems they had been diagnosed with: arthritis, chronic obstructive pulmonary disease, elevated cholesterol, hypertension and depression. One might expect these factors to affect self-rated health negatively and thus – following the findings of the logistic regression analyses – support a realistic self-assessment. However, interviewees did not include diseases and health problems in their assessment of diet healthiness. This finding is supported by the finding of the logistic regression analyses that elevated cholesterol was not significantly associated with self-assessment of diet healthiness. Instead, the qualitative findings showed how interviewees used their wellbeing as a justification for eating healthily enough, and it was in some cases found to overrule diseases and health problems. This is best exemplified by the two interviewees with elevated cholesterol and hypertension. They took their medicine and did not feel any symptoms. So despite of their diagnoses, they did not see enough reasons to change their diets – as long as they felt good. Wellbeing was only used positively and as a justification for eating healthily enough and the findings of the qualitative study do not support that poorer self-rated health functions as a sign of unhealthy diets. As the qualitative study included only 16 people, it cannot be concluded that this is a general case.

The results of the qualitative study suggest another possible explanation than self-rated health being a sign of either healthy or unhealthy diets. As suggested in other studies (Godino et al., 2014; Watkinson et al., 2010), one explanation could be that the causality is not as expected. The association between positive health indicators and optimistic self-assessment may simply imply that some people are optimistic about the healthiness of their diets as well as about their health. The interviewee, John, may be used to illustrate this. He considered his health to be excellent and his diets to be healthy enough to a high degree. At the same time he had elevated

cholesterol and hypertension and according to BMI standards he was overweight – but he did not consider himself as weighing too much. Therefore, “being generally optimistic” may be a confounder in the association between excellent self-rated health and highly optimistic self-assessment of unhealthy diets.

The findings of the qualitative study do also elaborate the findings of associations between health behaviours and optimistic self-assessments. Some of the interviewees included physical activity and smoking habits when they assessed the healthiness of their diets. The general observation was that the interviewees considered that being physically active affected the assessment positively, while smoking affected the assessment negatively. For example, one interviewee was well aware that he could eat healthier but because he was physically active, he concluded that his diets were healthy enough. Another interviewee stopped smoking, and in order to give himself some credit, he assessed his diets as more healthy than he would have done, if he was still smoking. These examples indicate that the association between health behaviours and optimistic self-assessment may imply that different health behaviours are perceived as a whole, and therefore the assessment of one behaviour is affected by the assessment of other health behaviours. This is in agreement with a review of qualitative studies that concludes that lay people have a more complex interpretation of healthy eating than health professionals (Bisogni et al., 2012).

Like wellbeing, health behaviours were also only included positively and not as a justification for unhealthy diets, and the association between physical activity and optimistic self-assessment may also be affected by a general optimistic view on own health and health behaviours – as exemplified above with John. People tend to emphasize their healthiness rather than their unhealthiness (Blaxter, 1990), and in an interview setting it is possible to present both wellbeing and health behaviours more positive than reality might be. This social desirability bias is often seen with behaviours related to social norms (Loosveldt, 2008). However, overweight and especially obesity are difficult to hide, and seem to appear as an apparent sign of unhealthiness. This might be one of the reasons why overweight was the only health characteristic in the qualitative interviews that was emphasized as a sign of unhealthy dietary habits.

The results from the logistic regression analyses of physical activity showed that men were more likely to be optimistic assessors while women were more likely to be pessimistic assessors. With regard to optimistic and pessimistic self-assessment of diet healthiness no gender difference was found. Three studies have found gender to be associated with optimistic self-assessment (Glanz et al., 1997; Variyam et al., 2001; Watkinson et al., 2010). In two of the studies, men were found to be more optimistic (Variyam et al., 2001; Watkinson et al., 2010),

while Glanz et al. (1997) found women to be more optimistic. Furthermore, in the present study, older adults were more likely to be optimistic about the healthiness of their diets and younger adults were more likely to be pessimistic. Age was also found to be associated with pessimistic self-assessment of physical activity. However, unlike the findings with regard to diet healthiness, middle-aged adults were more likely to be pessimistic assessors. None of the previous studies concerning diet healthiness found age to be associated with either optimistic or pessimistic self-assessment, whereas one of the previous studies about physical activity found older age to be associated with optimistic self-assessment (van Sluijs et al., 2007). With regard to educational level, the present study indicated that adults with basic education were more likely to assess their physical activity level pessimistically than adults with medium higher education. In contrary, previous studies indicated that lower educational levels were associated with optimistic self-assessment (Dijkstra et al., 2014; Glanz et al., 1997; Variyam et al., 2001; Watkinson et al., 2010).

4.3 Assessments by health professionals versus lay people's self-assessments

Overall, the findings of this thesis indicate that there are considerable differences in the criteria behind assessments of healthy diets and physical activity by health professionals and lay people. The differences can be explicated with four embodied dimensions of health identified by Watson (Holm & Smith, 2011; Watson, 2000). These dimensions cover bodily appearance (normative), the ability to manage demands in everyday life (pragmatic), experiencing wellbeing (experiential), and the biological body where health can only be conceived medically, for example through a blood test (visceral). All four dimensions are present in the considerations underlying interviewees' self-assessments of unhealthy diets in the present study. However the visceral dimension is the least apparent and seems not to be a decisive criterion in their self-assessments. For example, wellbeing and being capable of managing important tasks in everyday life override medical standards of overweight or diseases. Furthermore, the indicator of weighing too much typically relates to appearance rather than BMI. The importance of appearance rather than health as a key motivation behind dieting has been pointed out in previous studies (Clarke, 2002; Gough, Seymour-Smith, & Matthews, 2016). With regard to outcome expectancies of a healthier diet both wellbeing and appearance have been found to be more frequently mentioned than longer term health effects (Beck-Larsen & Kazbare, 2014).

In contrast to lay people, health professionals assess the healthiness of diets and physical activity on the basis of scientific evidence, documenting associations between diets, physical activity and specific diseases and health problems. Furthermore, compliance with FBDG is estimated on the basis of standardised measures of people's dietary intake and physical activity. This thesis indicates that lay people primarily base their assessments on feelings of

wellbeing and perceived weight status. The foundation of lay people's self-assessments is much more subjective and much more multifaceted than assessments by health professionals. This supports earlier findings that lay people have more subjective and broader conceptions of health (Blaxter, 1990) and more holistic views about healthy eating habits (Bisogni et al., 2012).

4.4 Methodological considerations

4.4.1 The Danish National Survey of Diet and Physical Activity

One strength of this thesis is the use of data from DANSDA that besides from enabling a mixed method study also include a nationally representative sample and thus enables generalizability of the results to the general adult population. A limitation is the low response rate of 52 %. Gender, age and education are considered to be key variables in surveys about diet and physical activity (Groth et al., 2001; Groth et al., 2014; Pedersen et al., 2015), and the weighting according to these variables are therefore a strength. However, weighting of data cannot fully substitute for missing data. Non-participants might differ systematically from the study sample in characteristics not accounted for in the weighting or in characteristics not possible to account for. It has been found that non-participants have more unfavourable health and health behaviours than participants (Christensen et al., 2015). Also overweight and obesity has been found to be more prevalent among non-participants (Nyholm et al., 2008). It is not possible to account for these health indicators in the weighting.

Following the findings of this thesis, non-participants – due to more negative indicators of health – would be expected to be more likely to be realistic about their unhealthy behaviours than participants. Consequently, the proportion of optimistic assessors might be overestimated in the present study and proportion of realistic assessors might be underestimated. It is also likely that participants in a survey about diet, physical activity and health are generally more health conscious and consequently more realistic or maybe even pessimistic about the healthiness of their diets and physical activity. If this is the case, the proportion of optimistic assessors might be underestimated in the present study and proportion of realistic and pessimistic assessors might be overestimated.

Another issue to consider is the risk of participants giving social desirable answers. This is likely to occur in surveys about behaviours related to social norms, and especially in face-to-face interviews (Loosveldt, 2008). Of special concern in the present study, participants may have overestimated the healthiness of their diets and physical activity. Or maybe some participants have chosen a safe middle range category, such as "to some degree healthy enough" and "moderate physical activity" instead of an extreme category. There is also a risk of participants

overreporting their intake of healthy foods and/or underreporting their intake of unhealthy foods in the food diaries (Heitmann et al., 2000; Rasmussen et al., 2007). Furthermore, due to reactivity, participants may have increased their intake of healthy foods or their activity level in the registration period (Dwyer, 1994). Depending on the combination of potential social desirable answers, the proportions of optimistic and pessimistic assessors may be influenced, and the findings should be evaluated in this light.

The co-variates included in the logistic regression models have not undergone thorough validations. However, most of the co-variates have been used in large-scale population-based health surveys in Denmark repeatedly in the last decades (Ekholm et al., 2009). The categorisation of educational level is carefully checked on the basis of all four sub-questions, and the level of education is classified in accordance with Statistic Denmark's nomenclature of education (Statistic Denmark, 2001). The measure of self-rated health is part of the standard questionnaire SF-12 developed to measure state of health, and the question has proved to predict mortality (Desalvo et al., 2006). The variable 'elevated cholesterol' is based on a doctor's diagnosis and self-reported smoking is an internationally accepted measure of smoking behaviour (European Commission Eurostat, 2006). Finally, the co-variates of weight status and abdominal weight status are based on anthropometric measurements and categorised in accordance with international standards (World Health Organization, 2000).

4.4.2 The qualitative study

The criteria for discussing validity, reliability and generalisability of qualitative studies differ from the criteria developed in natural science (Kvale & Brinkmann, 2009; Lewis & Ritchie, 2003; Miles & Huberman, 1994; Olsen, 2003). Some qualitative researchers refuse to assess the validity, reliability and generalisability. Other qualitative researchers use other terms, considered to be more suitable. Thus, instead of 'validity', terms such as credibility or plausibility are applied (Lewis & Ritchie, 2003). Confirmability, consistency or dependability are applied instead of 'reliability', and 'generalisability' is often referred to as transferability. Some researchers apply the terms validity, reliability and generalisability (Kvale & Brinkmann, 2009; Lewis & Ritchie, 2003), however in their broadest conception, reliability meaning sustainability and validity meaning well-grounded. In order to assess the quality of qualitative research, different, however not identical, queries are proposed (Kvale & Brinkmann, 2009; Lewis & Ritchie, 2003; Miles & Huberman, 1994; Olsen, 2003). Common to the queries are a critical assessment of the different stages of the qualitative research process. In this thesis, the quality of the qualitative study is discussed on the basis of queries proposed by Ritchie & Lewis.

The recruitment of interviewees in the qualitative study among participants in DANSDA 2011-2013 is unique and a marked strength as it makes it possible to select interviewees on the basis

of specific recruitment criteria; first of all their diet quality and their self-assessed diet healthiness that enables the comparison of optimistic and realistic assessors. Furthermore, the targeted recruitment made it possible to obtain a differentiated sample with regard to gender, age and education and thereby identify shared themes and patterns across these variations. Given the limited resources it was not possible to select a sample that might facilitate a systematic exploration of the meanings underlying the identified associations in the quantitative studies. However, weight status emerged from the initial analysis as a decisive criterion in interviewees' self-assessments, and it was the theme where the most convincing difference between optimistic and realistic assessors was found. Therefore, the differentiation in weight status among interviewees became relevant. It turned out that most of the optimistic assessors were normal weight, while most of the realistic assessors were overweight. This finding widened the analytic focus on weight, being critical about the initial finding of weight status being a decisive criterion in diet health assessment. However, instead of rejecting the finding, it became clear that weight status was not the only issue of importance. Rather, realistic assessors, who were not overweight, were concerned about their weight, either because of previous experiences with gaining and losing weight or due to a present focus on not gaining weight. The importance of weight history and weight concerns was not found among optimistic assessors, disregarding their current weight status. Therefore, the conclusions would most likely remain unchanged, if weight status had been adopted as a recruitment criterion such that a more equal distribution of weight status between the two sub-groups had been achieved. Nevertheless, it cannot be excluded that the unequal distribution of weight status within the two sub-groups may have affected the results. Maybe the importance of weight status would be moderated and maybe the importance of weight history and weight concerns enhanced. Thus, the findings should be evaluated in this light.

Overall, the quality of questioning seemed sufficiently effective for interviewees to express their views. Most interviewees, regardless of gender, age and education responded to all the relevant questions and often with thorough responses. Only one interviewee differed from the norm. It seemed difficult for him to respond to several of the questions, and sometimes his wife, sitting in the background, responded on behalf of him. The interview lasted no more than 16 minutes. In the interviewer's reflections following the interview, possible reasons for the short interview were reflected upon:

> "The interview is very brief. I didn't even think it was possible to do it so quickly. Language seems to be a barrier but possibly also the topic. Health/healthy food does not appear to be a topic that Samir is used to talking about. His answers are very brief and I rarely ask him to elaborate as I have a feeling that he doesn't know how to answer, and I don't want to make him feel uncomfortable.

> Furthermore, he seems a bit shy. He looks away when we talk. Avoids eye contact. Perhaps because I'm a woman. Perhaps because I'm a stranger. Perhaps because I'm a researcher. Perhaps because of the division of roles."

Despite the limitations of the interview, the interviewee still addressed several relevant topics, and the interview was therefore considered useful. In order to reduce social desirable answers from interviewees, the interviewer emphasised that nutrition was not her profession and that she was not interested in their dietary habits as such. The interviewer was offered cake, chocolate, candy, peanuts and soft drinks, which indicate the opposite to social desirable behaviours, and in general the interviewees seemed to be open about their unhealthy dietary intake.

The present study aimed at identifying overall themes, derived from empirical data, and the themes were based on the wordings of the interviewees. As such, the themes are considered to reflect the meanings assigned by interviewees. However, it cannot be excluded that some of the interpretations are considered not to be accurate by some of the interviewees. The interpretation of criteria underlying interviewees' self-assessment of unhealthy diets was based on multiple repetitions throughout the totality of interviews as well as throughout each of the interviews. Themes that were derived from only a few interviews were given limited importance, for example the role of former dietary habits. Furthermore, the search for rival explanations or negative evidence did not question the initial findings. In addition, citations from the original data are presented, making the analytical constructions transparent to the reader.

In order to enhance the quality of the study, the aim and study design, the identified themes and the interpretation hereof were regularly discussed with a group of sociologist and anthropologist researchers within the field of food. This helped to ensure the reliability of the findings. Furthermore, information about recruitment, interview guide and data collection as well as the analytical process is presented to the reader. This ensures transparency and thus a potential replication of the study and is an important precondition to obtain consistent findings (Lewis & Ritchie, 2003). Further, it enables the reader to assess the reliability.

With regard to generalisability, it is relevant to distinguish between representational generalisation and inferential generalization (Lewis & Ritchie, 2003). The former refers to the generalisability of findings to the population from which the sample is drawn, while the latter refers to the generalisability of findings to other settings or contexts beyond the sampled one. In order to obtain representational generalisation, the sample need to represent the population from which the sample is drawn (Lewis & Ritchie, 2003). Also in this context, the targeted recruitment of interviewees is a strength. However, it does not mean that findings can be generalised on a statistical basis. Neither, the individual interviews are generalisability. Instead,

it is at the level of categories, concepts and explanations across interviews that generalisation can take place (Lewis & Ritchie, 2003). Thus, the decisive criteria in interviewees' self-assessments, identified throughout the totality of the interviews, are considered to be likely to be generalised to the population from which the sample is drawn. This is supported by the identified overlap between findings in the quantitative and the qualitative study. It is important to highlight that a larger sample than 16 interviewees might have added perspectives to the findings (Lewis & Ritchie, 2003). The possibility to generalise the findings of the qualitative study to other settings or context are considered to be less evident and is not intended by the present study.

4.4.3 The time gap between DANSDA 2011-2013 and the qualitative study

The interviewees of the qualitative study are selected on the basis of several individual characteristics identified in DANSDA 2011-2013. The interviews in this thesis were conducted in the beginning of 2015, two to four years after the interviewees participated in DANSDA. Therefore, potential changes of interviewees' key characteristics should be considered.

The primary selection criteria were diet quality and self-assessed diet healthiness; subsequently, gender, age and education. Therefore, interviewees were asked about potential changes in dietary habits and also about changes in family, work and education. The latter criteria might also influence both dietary habits and self-assessed diet healthiness. Changes in family, work and education were minor and did not seem to affect interviewees' dietary habits or their self-assessed diet healthiness. Some of the interviewees had changed their diets; all belonging to the group of realistic assessors. Three had unhealthier diets and had gained weight. Thus, they still belonged to the group with unhealthy diets and they were still aware of not eating healthily enough. One ate healthier and had lost some weight. However, he also ascribed his weight loss to physical activity and he described a range of unhealthy foods he was still eating and enjoying. He described his weight loss as an ongoing and long process. From his descriptions nothing indicated that his present diet on the basis of the applied diet index would be categorized as a healthy diet. However, it cannot be ruled out that his diet was no longer 'unhealthy'. Nevertheless, as his self-assessed diet healthiness was also less negative in the present study than when he participated in DANSDA, there is no reason to believe that he was no longer realistic about the healthiness of his diets. Due to the results of this thesis, changes in weight status are likely to affect interviewees' self-assessments. However, the reported weight changes followed the same pattern as the above-mentioned dietary changes and did not question the classification of optimistic and realistic assessors.

One difference between interviewees' responses in DANSDA and in the present study needs to be considered. Thus, when interviewees were shown the response categories of the question

"Do you consider your dietary habits to be healthy enough?" several of them categorised themselves in middle range categories and in between categories, typically "yes, to some degree" instead of "yes, to a high degree" or in between the two categories. As accounted for above, the differences in self-assessment between the two studies did not seem to be influenced by changes in dietary habits, weight or life circumstances such as family, work or education. Instead, the differences are likely to be a natural consequence of methodological differences between DANSDA and the qualitative study of this thesis. Firstly, the participants in DANSDA were not shown the response categories. Instead, the interviewer probed the responses and chose the category best fitting the responses. When interviewees in the qualitative study saw the response categories, some of them explained that they did not want to place themselves in an extreme category, because they did not see themselves as being among the healthiest or unhealthiest. This seems to be one reasonable explanation of the detected difference between the categorisations of two studies. Secondly, the aim of the qualitative study was to gain in depth understanding of what underlies interviewees' responses to the question "Do you consider your dietary habits to be healthy enough", and several additional questions were asked. In DANSDA, the aim was to place the participants in a response category rather fast. It seems reasonable that the more in depth reflections draw the interviewees to more complex and less clear-cut responses when asked to choose a response category. Overall, despite the tendency to select in-between and middle range categories to a greater extent in the qualitative study, the overall classification of 'optimistic assessors' and 'realistic assessors' was replicated in the present study. The classification of optimistic and realistic assessors on the basis of quantitative data thus proved useful in the qualitative study insofar as it mediated an understanding of some marked points of difference between optimistic and realistic assessors as well as several points of similarity. Rather than giving rise to a critic of either one of the studies, the differences in responses are considered to highlight the methodological differences and the different nature of findings derived from qualitative and quantitative studies, respectively.

4.4.4 Strengths and limitations of the measures of actual and self-assessed diet healthiness and physical activity

Optimistic and pessimistic self-assessment of diet healthiness were defined by comparing participants' diet quality with their self-assessed diet healthiness, while optimistic and pessimistic self-assessment of physical activity were defined by comparing pedometer-determined and self-assessed physical activity. Some methodological issues have to be considered with regard to each of the four measures and their combinations. The different assessment groups involve self-assessments that on one hand differ from a health professional assessment (optimistic and pessimistic self-assessments) and on the other hand accords with a health professional assessment (realistic self-assessments). Unlike the use of the term

"awareness" in previous studies (Table 1 and 2), the definition of the different assessment groups do not imply what might be the reasons for the differences. The intention was to apply a neutral description of differences between assessments by health professionals and lay people, and is as such considered valid.

4.4.4.1.1 Food diaries and self-assessed diet healthiness

A strength of this study is that estimated diet quality measures are based on data derived from seven-days pre-coded food diaries that are considered more accurate (Thompson & Subar, 2008) than food frequency questionnaires applied in other studies in this area (Brug et al., 1994; Dijkstra et al., 2014; Glanz et al., 1997; Jansink et al., 2012; Lechner et al., 1997). The assessment method has been validated against an objective measure of energy expenditure and has shown moderate to good ability to rank individuals according to high or low energy intake (Biltoft-Jensen et al., 2009). The categorizations of healthy and unhealthy diets were based on a modified version of a validated diet quality index (Knudsen et al., 2012). The diet index has proved to be a useful tool to describe the degree of compliance with FBDG. A limitation of the index is that the different foods and nutrients have the same weight regardless of their association with the risk of diseases. Weighting the different foods and nutrients in accordance with the risk of diseases would require specific knowledge on the importance and contribution of the various foods and nutrients in relation to the risk of diseases and was not done. The diet index does not include absolute cut-off points defining healthy, intermediate and unhealthy foods – but a score that mirrors the compliance with 5 of the 10 food-based dietary guidelines that are quantifiable. As it was less than 1 % of the participants that fulfilled all of the 5 selected guidelines, it was not possible to define a specific cut-off point of healthy diets according to health professionals' definitions. Therefore, the categorizations of healthy and unhealthy diets were based on a relative measure. It is a strength that the identified proportions of optimistic and pessimistic assessors were found not to be sensitive to different cut-off points.

It is a limitation of this study that the question used to measure self-assessed diet healthiness has not been validated in the context used in this study. However, in accordance with the intention of the question, the qualitative study showed how interviewees did consider the healthiness of their diets subjectively when responding to the question. Furthermore, the overall categorisation of optimistic and realistic assessors was replicated in the qualitative study. Another limitation of the question is the rather broad response category "to some degree" and compound with the wording of the question "to some degree healthy enough". The categorisation indicates that the participant's dietary habits might well be healthy but also include less healthy foods or eating practices. The fact that half of the participants are categorised in this response category, substantiate a rather broad interpretation of what defines this category. Due to the risk of misclassifying participants as optimistic or pessimistic assessors

on the basis of this response category, it was decided to distinguish between highly and somewhat optimistic/pessimistic assessors. Furthermore, somewhat optimistic and somewhat pessimistic assessors were only included in the outcome of the logistic regression models in sensitivity analyses. Not being able to include questions developed for the specific objectives of the thesis is considered a limitation by applying existing data from DANSDA. However, the advantages by applying data from DANSDA are still considered to exceed the disadvantages.

Data on diet quality were collected in seven consecutive days, while data on self-assessed diet healthiness was a general assessment. Thus, the reference periods of actual diet quality may not be representative of the self-assessed diet healthiness. In DANSDA 2011-2013, 70 % reported that their dietary intake in the registration period corresponded to their normal dietary habits (unpublished data from DANSDA 2011-2013). Thus, it cannot be excluded that some of the remaining 30 % were misclassified on this basis. However, participants' self-assessed disagreement between their dietary intake in the registration period and their normal dietary habits needs to be interpreted carefully. Deviations in the registration period, such as a birthday, prompt participants to report that their dietary intake do not correspond with their normal dietary habits even though a birthday party is not unusual in most people's lives. Furthermore, it would require significant dietary changes in the registration period to be classified in a different group of healthy, intermediate and unhealthy diets, and the issue is therefore considered to be of minor importance.

Another issue to consider is whether one measure is influenced by the other. As participants assessed the healthiness of their diets before the seven day food registration, self-assessed diet healthiness are not likely to be influenced by the registration of dietary intake. On the contrary, it cannot be ruled out that people with a positive self-assessment – in order to maintain their self-image – also are more likely to overreport the intake of healthy foods and underreport the intake of unhealthy foods. If this is the case, the proportion of optimistic self-assessments might be underestimated in the present study.

4.4.4.1.2 Pedomter and self-assessed physical activity

An objective measure of physical activity was applied in this thesis contrary to most of the previously published studies in this area (Jansink et al., 2012; Lechner et al., 2006; Ronda et al., 2001; van Sluijs et al., 2007). The pedometer used is considered to be one of the most accurate electronic pedometers and suitable for research in free-living conditions in large populations (Schneider et al., 2004). Objective measures eliminate the risk of recall bias and minimizes the risk of social desirability bias (Sallis & Saelens, 2000). However, despite the strength of applying an objective measure, there are potential limitations with the use of pedometers. First, they do not capture non-ambulatory activities such as cycling. As cycling is a

common activity in Denmark (Matthiessen et al., 2015), step equivalents for cycling were added. Second, there is a risk of reactivity. To minimize this, pedometers were sealed during the day (Clemes & Parker, 2009) and participants were encouraged not to modify their physical activity level during the recording period. Finally, pedometers do not measure intensity, but studies have shown that steps per day may explain 65 % of the variation in time spent in moderate to vigorous activities according to accelerometry measures (Tudor-Locke, Johnson, et al., 2011).

The cut-off points defining inactive (<8,000 steps/day) and active (≥10,000 steps/day) adults are substantiated in relevant literature (Tudor-Locke & Bassett, 2004; Tudor-Locke et al., 2013; Tudor-Locke, Craig, et al., 2011). It is a strength that sensitivity analyses of cut-off points plus/minus 500 steps/day did not show any significant difference in the proportion of optimistic and pessimistic assessors, respectively (data not shown). Steps between 8,000-9,999 steps/day are defined as being somewhat active. Participants with 8,000-9,999 steps/day were not included in the analyses as it was considered not to be reasonable to categorise them as either optimistic or realistic assessors with the measure of self-assessed physical activity available. The exclusion of participants taking 8,000-9,999 steps/day in the analyses may be considered a limitation of the study.

Another potential limitation is that pedometer data included waking hours while self-assessed physical activity referred to participants' leisure time activity. This might result in misclassifications of participants as pessimistic assessors if they have a physically demanding occupation and a sedentary leisure time. However, the sensitivity analyses did not indicate significant differences in the proportions of pessimistic assessors in the different occupational activity levels (data not shown). Furthermore, when occupational activity was included in the regression model, the variable was not associated with pessimistic self-assessment. Therefore, this issue is considered not to have affected the conclusions.

Pedometer data were collected in seven consecutive days, while data on self-assessed physical level referred to the last year. Thus, the reference period of pedometer-measured physical activity may not be representative of the self-assessed physical activity level. In DANSDA 2011-2013, 64 % reported that their physical activity in the registration period corresponded to their normal physical activity (unpublished data from DANSDA 2011-2013), and it cannot be excluded that some of the remaining participants were misclassified on this basis. However, as mentioned with regard to the analyses of diet, participants' self-assessed disagreement between their physical activity behaviour in the registration period and their normal physical activity behaviour needs to be interpreted carefully.

4.5 Implications for practice

The findings of this thesis suggest that lay people base their self-assessments of the healthiness of their diets, and probably also of physical activity, on subjective feelings of wellbeing and their body weight. It underlines important differences between assessments of healthy diets and physical activity by lay people and health professionals. This overall finding supports the importance, and most likely also the benefits, of health professionals to, firstly, be aware of how some people have very different perspectives when it comes to healthy diets and physical activity and, secondly, take this into consideration in the planning of health promotion initiatives.

Previous studies highlight that awareness of unhealthy behaviours may function as a prerequisite for being motivated to change to healthier behaviours. Personal feedback on dietary intake and physical activity has been suggested as a potential strategy to increase people's awareness. The findings of the qualitative study of this thesis encourage a discussion of what it is people need to be aware of and adds to the suggested strategy. As described above, several of the interviewees were well aware of their unhealthy diets without having any intention to change them as long as they felt good and did not weigh too much. Thus, awareness of unhealthy eating behaviours was not motivation enough to initiate dietary changes. One implication of this could be that awareness of unhealthy behaviours does not seem to be as important as highlighted in previous studies. However, it might also indicate that the essence is not awareness of unhealthy diets or insufficiently physical activity, but awareness of a *health risk behaviour*. Thus, some people might be well aware that they eat unhealthily, but as long as they feel good or do not weigh too much, they do not perceive their unhealthy diets as a *health risk behaviour*. The finding that normal weight seems to function as a sign of healthy eating for lay people, points to a need for health promotion initiatives to clarify that weight status is not always an indicator of diet healthiness, and that unhealthy diets can be a risk factor for non-communicable diseases regardless of present weight status. In addition, it also seems relevant in future health promotion initiatives to clarify that unhealthy diets, regardless of present wellbeing, are likely to have long-term adverse health effects. Attention to these issues might encourage people to reconsider the healthiness of their diets and physical activity even though they feel good, are not overweight or concerned about their weight status – and may be an important starting point of initiating a behaviour change process.

Another important implication of the findings of this thesis, as well as in other studies within this field, is the risk of misclassifying the healthiness of people's behaviour, when the classification is based on self-assessed measures. As described in the Introduction, and with a reference to the Stages of Change Model, this is problematic in health promotion initiatives where people's behaviour is important for how they are intervened upon. If people are misclassified, the

intervention is unlikely to be effective. The risk of misclassifying individuals' health behaviour is also an important implication to be aware of in research. According to the findings of this thesis, men are more likely to be optimistic when assessing their physical activity. This is an important implication to be aware of in studies based on self-assessed measures and indicating gender differences in physical activity level.

The rather high proportion of pessimistic self-assessment found in the present study is also a result that merits attention in relation to practice. Pessimistic self-assessment – eating healthy and/or being physical active, however assessing it as insufficiently – is likely to be an indication of an overstated health ideal that some people are trying to live up to. The huge focus on obtaining a healthy and beautiful body in the media is likely to be important contributors to this unrealistic health ideal. However, the risk of overstating a health ideal is something health professionals should also take into account in the planning of future health promotion initiatives.

Both the Precaution Adoption Process Model and the Stages of Change Model are models of individual health behaviour, focusing on factors within the individual that stimulate behaviour change. As described in the Introduction, many of the present public health initiatives in Denmark, aiming at promoting healthier diets and a more physically active lifestyle, intervene at structural levels such as availability of healthier food products and better access to public green areas. However, such ecological approaches do not minimise the importance of factors at the individual level (Reynolds et al., 2004), and people's optimistic self-assessments are still likely to affect the effectiveness of health promoting initiatives based on a more ecological approach. Thus, if people consider their dietary habits and physical activity to be healthy enough, the motivation to choose keyhole labelled foods or make use of environments enhancing physical activities are likely to be lacking. In order to overcome the barrier of people's optimistic self-assessment, it may be beneficial with health promotion initiatives, such as passive interventions, that are independent of individual factors. One example could be a general salt reduction in available breads products in supermarkets or a general sugar reduction in soft drinks. However, such initiatives call for thorough considerations of ethical issues with regard to balancing individual choices and environmental control (Reynolds et al., 2004).

5. Conclusions

The findings of this thesis suggest that a considerable proportion of Danish adults assess the healthiness of their diets and physical activity level differently than assessed by health professionals. Further, the findings indicate that favourable health characteristics such as excellent self-rated health and normal weight are associated with optimistic self-assessments, while less favourable health characteristics such as good self-rated health and obesity are associated with pessimistic self-assessments. The findings of the qualitative study indicate that feeling good and being normal weight function as signs of healthy dietary habits, while overweight and being concerned about personal weight status seem to support a realistic assessment of unhealthy dietary habits.

5.1 Future research

In this thesis considerations underlying lay people's self-assessment of *healthy* diets were not explored. Doing so might bring about more perspectives than this thesis was able to reveal, and it would clarify if the findings of the qualitative study are also evident beyond this exact sample. In order to explore if the findings of the qualitative study also apply to lay people's self-assessment of their physical activity, and thus obtain a broader health behaviour perspective, considerations underlying lay people's self-assessment of their physical activity should be explored in future research. Such explorations may also shed more light on another finding of the thesis – that health behaviours seem to be assessed not only as distinct behaviours but as a whole.

The finding of gender differences in the study of physical activity and not in the study of diet indicates some interesting gender differences in self-assessments of health behaviours. More research on this issue might bring about useful knowledge in order to understand identified gender differences in dietary habits and physical activity.

In order to draw more solid conclusions with regard to the dominant role of weight status and weight concerns in self-assessments of diet healthiness, more research is needed. Furthermore, the finding that several of the interviewees only intended to change their dietary habits if it was followed by a desire to lose weight should be further explored. Future research should include interviewees' weight status as a recruitment criterion.

With regard to the findings that nutritional knowledge and perceptions of healthy eating appear to be of limited importance in self-assessments of unhealthy diets and do not constitute distinguishing features of 'optimistic' or 'realistic' self-assessments, it would be fruitful if these

findings were further explored in quantitative studies examining associations between nutritional knowledge and optimistic/pessimistic self-assessment.

Finally, the findings of a relative high proportion of adults with healthy diets and active adults being pessimistic assessors substantiate a need for in-depth explorations of what underlies this phenomenon.

Appendix I: Interview Guide

Baggrundsoplysninger
Ændringer i uddannelse, arbejde og familie siden deltagelse i kostundersøgelsen?

Ændringer i madvaner?

Hvordan italesætter IP mad og måltider og hvad fremhæves i fortællingen om mad og måltider?
Kan du huske, hvad du fik at spise i går? (Hvad? Morgen, middag, aften og imellem måltiderne)

Vil du sige, at det er det, du normalt spiser i løbet af en dag?

Hvad er et godt måltid?/Hvad er dine yndlingsretter? Hvorfor?

Hvilke tanker og overvejelser ligger bag IP's svar på spørgsmålet: "Synes du, dine kostvaner er sunde nok?"? Hvad er IP's kriterier for "sund nok"?
Synes du, dine kostvaner er sunde nok? Hvorfor? Spørg ind, følg "røde lygter"

Kan du sige lidt om, hvad der fik dig til at svare ___? Kan du sige lidt om, hvilke tanker/overvejelser, der løb igennem dit hoved, da du svarede ___?

Jeg spørger om dine kostvaner er sunde nok – kan du uddybe hvad sundt nok betyder for dig/hvornår mad er sundt nok for dig? Hvad får dig til at vurdere, at dine kostvaner i høj grad/i nogen grad/kun til dels/ikke er sunde nok?

Hvordan vil du beskrive sund mad og omvendt usund mad?

Vis svarkategorierne og få IP til at placere sig selv. Hvad skal der til for at rykke op og ned i kategorierne?

I tilfælde af IP ikke svarer det samme som da denne blev interviewet ifbm. DANSDA:
Det her spørgsmål blev du også stillet dengang du deltog i kostundersøgelsen. Dengang svarede du ___ Kan du sige lidt om, hvad du tænker, der kan ligge bag, at du i dag svarer ___?

Hvilken betydning har sunde madvaner for IP?
Betyder det noget for dig at spise sundt?/ Er det overhovedet vigtigt for dig at spise sundt?/ Er det noget du går op i? Tænker du over det til dagligt? Hvorfor?

Har det altid været sådan?

Er sundhed noget, du bekymrer dig om – fx i forhold til at undgå overvægt eller sygdomme som fx sukkersyge, hjerte-kar-sygdomme/blodpropper?

Hvis du nu fik at vide, fx af en diætist, at dine madvaner, rent ernæringsmæssigt, ikke er så sunde… Hvad ville du så sige til det… Ville det overraske dig? Ville det betyde noget for dig? Ville du ændre noget?

Hvad forstår IP ved sundhed/usundhed?
Nu har vi snakket meget om mad… men sundhed kan jo være rigtig mange ting og helt andre ting end mad… kan du sige lidt om, hvad sundhed er for dig/hvad forbinder du med ordet sundhed?

Ift de andre ting du nævner, hvilken rolle spiller mad så?

Kan du prøve at beskrive en meget sund person og en meget usund person?

Hvis du skulle placere dig selv i forhold til de her to personer, hvor vil du så placere dig? Er du tæt på/langt fra denne sunde/usunde person?/skala fra 1-10. Hvorfor?

Føler du dig sund? Hvordan kan du mærke det? Hvornår føler du dig særlig sund?

Hvad er IP's kendskab til, forståelse og brug af samt holdning til de officielle kostråd?
Følger du nogle bestemte retningslinjer/personlige regler ift. det du spiser?

Hvor vil du sige, at du har din viden om sund/usund mad fra?

Kender du de officielle kostråd?

- Kan du nævne nogle? Er der nogle, du har bidt særligt mærke i? Hvilke?
- Ved du, hvad de mere specifikt indeholder? (Hvor mange kostråd er der? Ved du hvordan det overordnede kostråd lyder? Hvilke fødevarer/makronæringsstoffer er der fokus på?)
- Går du op i at sætte dig ind i, hvad de officielle kostråd går ud på?

Andet
Er der noget du har lyst til at tilføje, fx ift. det vi har snakket om?

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Paper I-III

Paper I

Optimistic and pessimistic self-assessment of physical activity is associated with gender and self-rated health in Danish adults

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Abstract

Aims: To examine the extent to which Danish adults assess their physical activity level optimistically and pessimistically and further, to examine socio-demographic, health and behavioural characteristics associated with such optimistic and pessimistic self-assessment. *Methods:* The cross-sectional analysis included 1418 participants aged 18-75 years from the nationwide representative survey The Danish National Survey of Diet and Physical Activity 2011-12. Optimistic self-assessment of physical activity was defined as taking less than 8,000 pedometer-measured steps/day (inactive) and assessing own activity level as moderate or vigorous. Pessimistic self-assessment was defined as taking at least 10,000 steps/day (active) and assessing own activity level as light or sedentary. Multiple logistic regression models were used to examine factors associated with optimistic and pessimistic self-assessment. *Results:* Among inactive (39 %), 27 % were optimistic assessors, and among active (41 %), 50 % were pessimistic assessors. Men and adults with excellent self-rated health were more likely to be optimistic assessors. Women and 45-64-year-olds, adults with basic education and with an income <250,000 DKK, adults with good or very good self-rated health and adults that only partly/not at all considered their diets to be healthy enough were more likely to be pessimistic assessors. *Conclusions:* Gender and self-rated health were associated with both optimistic and pessimistic self-assessment of physical activity. Future public health initiatives should address especially optimistic self-assessments among men. The results suggests a need to promote health benefits of physical activity regardless of present health status and to clarify to the general population that health status is not always an indicator of sufficiently or insufficiently physical activity.

Keywords

Pedometer, steps, self-assessed physical activity, optimistic assessors, pessimistic assessors, cross-sectional study, representative sample, adults

Introduction

It is well-established that physical activity promotes health and prevents non-communicable diseases (Lee et al., 2012; Physical Activity Guidelines Advisoty Committee, 2008; World Cancer Research Fund/American Institute for Cancer Research, 2007). In accordance with evidence-based international guidelines (Haskell et al., 2007; World Health Organization, 2010), the Danish Health and Medicines Authority recommends Danish adults to engage in minimum 30 minutes moderate to high intensity activity per day (Danish Health Authority, 2011). A physically active lifestyle is also recommended as part of the official dietary guidelines in order to balance energy expenditure and thereby maintain a healthy weight (Danish Veterinary and Food Administration, 2013).

In the adult Danish population, moderate to vigorous leisure-time activity level has increased from 20 % in 1987 to 28 % in 2010 (Christensen et al., 2012). However, recent trend data of adults' pedometer-measured physical activity showed a decrease in daily steps among women from 2007 to 2012, while steps per day were stable among men (Matthiessen et al., 2015). Furthermore, a report showed that 41 % men and 47 % women did not meet the physical activity recommendation (Matthiessen et al., 2009).

Several studies suggest that one possible barrier in the promotion of physical activity may be that people assess their physical activity level more optimistically than it really is, and consequently, they do not see a need to become more physically active (Godino et al., 2014; Jansink et al., 2012; Ronda et al., 2001; van Sluijs et al., 2007). The studies show how inactive individuals, who assess their activity own level to be sufficiently, are less likely to intend to change their physical activity than people who are realistic about their inadequate activity level. The association between self-assessment and intention to change is explained by referring to the Precaution Adoption Process Model (Weinstein, 1988). In this model, behaviour change is viewed as a process in different stages and in order to be motivated to initiate a behaviour change process, people need to be aware that their behaviour is a potential health risk.

Previous studies have found that 16-36 % of the examined populations assess their physical activity level optimistically, while 6-23 % assess their activity level pessimistically (Godino et al., 2014; Lechner et al., 2006; Ronda et al., 2001; van Sluijs et al., 2007; Watkinson et al., 2010). Several of the studies show that self-assessment of physical activity seems to be associated with indicators of health, such as weight status (Godino et al., 2014; Lechner et al., 2006; van Sluijs et al., 2007; Watkinson et al., 2010). Most of the studies are conducted in the Netherlands (Jansink et al., 2012; Lechner et al., 2006; Ronda et al., 2001; van Sluijs et al., 2007) and two in the UK (Godino et al., 2014; Watkinson et al., 2010). The study designs are cross-sectional and include non-representative samples such as older people (Godino et al., 2014), patients with type 2 diabetes or in high risk of type 2 diabetes (Jansink et al., 2012; van Sluijs et al., 2007; Watkinson et al., 2010) and people from local communities (Godino et al., 2014; Ronda et al., 2001; Watkinson et al., 2010). As national physical

activity recommendations and other public health promotion initiatives are targeted the general population (Danish Cyclists' Foundation, 2016; Danish Health Authority, 2011, 2012; Ministry of Transport, 2014; National Board of Health, 2003; Stockmarr et al., 2016), it is important to study optimistic and pessimistic self-assessment in the general population.

To the authors knowledge neither optimistic nor pessimistic self-assessment of physical activity has been examined in a representative sample of a general adult population by comparing objectively measured physical activity with a self-assessment instrument. The aim of the present study was to examine the extent to which Danish adults assess their physical activity level optimistically and pessimistically and further, to examine socio-demographic, health and behavioural characteristics associated with such optimistic and pessimistic self-assessment.

Methods

Study design and participants

Data were derived from The Danish National Survey of Diet and Physical Activity 2011-12 (DANSDA). DANSDA is a nationwide, cross-sectional survey with data on dietary habits, physical activity, and weight status as well as socio-demography and participants self-assessed health behaviours. The survey is collected in a nationwide random sample of the Danish population. Participants are drawn from the Danish Civil Registration System (Pedersen, 2011). A total of 2924 18-75-year-olds were drawn from the Danish Civil Registration System of whom 1515 individuals recorded their steps. This corresponds to a response rate of 52 %. Compared to the Danish population, individuals with basic education were underrepresented, while men and 19-54 year olds were slightly underrepresented (Pedersen et al., 2015).

DANSDA was conducted in accordance with the Declaration of Helsinki and approved by the Danish Data Protection Agency. The Danish National Committee on Health Research Ethics reviewed the study protocol and concluded DANSDA did not require approval according to Danish Law.

Measures

Pedometer-measured physical activity

Participants wore a cable-tie-sealed pedometer (Yamax SW-200, Tokyo, Japan) for seven consecutive days and measured steps during waking hours. An exception was time spent in water-based activities (bathing, showering, and swimming). Data were collected all year round. Participants recorded relevant information every day in a step diary adapted from Tudor-Locke (Tudor-Locke et al., 2004), including steps per day, time of pedometer attachment and removal, non-wear-time during hours awake, sickness or injury, time spent on cycling, time spent on exercise and sports and verification of properly wearing the pedometer. Trained interviewers instructed the participants on how

to wear the pedometer and how to fill out the step diary in accordance with standardized procedures. To minimize reactivity pedometers were sealed during the day (Clemes & Parker, 2009). Participants were encouraged not to modify their physical activity level during the recording period. Days with a minimum of 10 hours wear and steps between 100 and 50,000 were accepted as valid (Bassett et al., 2010; Troiano et al., 2008). Participants with a minimum of four valid days and an average of between 1000 and 25,000 steps per day were included in the analysis unless low or high step counts could be verified by the step diaries (Tudor-Locke, Bassett et al., 2011).

Adding cycling to pedometer-measured physical activity

Pedometers do not capture non-ambulatory activities, such as cycling, swimming, weight training, and horseback riding. As cycling is a common and frequently reported activity in Denmark (Matthiessen et al., 2009) cycling was adjusted for by using the conversion of cycling into step equivalents with 200 step equivalents/min of cycling (Miller et al., 2006; Rothausen et al., 2010). To adjust for double-counting, 40 steps/min were subtracted from the 200 step equivalents/min (Rothausen et al., 2010). Further, in order to avoid overestimation, an addition of more than 10,000 step equivalents/day was truncated to 10,000 step equivalents/day. In the present study, time spent on cycling is included in the pedometer-measured steps by adding 160 step equivalents per minute of cycling.

Self-assessed physical activity

Information about self-assessed physical activity was obtained with a standard question developed by Saltin & Grimby (Saltin & Grimby, 1968): "If we look back at the past year, what would you say best describes your leisure activities?". The question was part of a structured questionnaire conducted in face-to-face interviews by trained interviewers and the response categories were: (1) Heavy exercise and competitive sports regularly and several times a week (vigorous); (2) Exercise or heavy gardening at least 4 hours a week (moderate); (3) Walking, biking or other light exercise at least 4 hours a week (light); (4) Reading, watching TV or other sedentary activity (sedentary). The validity of the classification of people's physical activity in the different activity levels has been substantiated in several studies (Ekelund et al., 2006; Grimby et al., 2015; Matthiessen et al., 2008) and the question has been used widely in several large population-based surveys (Christensen et al., 2012; Grimby et al., 2015; Matthiessen et al., 2008; Rasmussen et al., 2012).

Optimistic and pessimistic self-assessment of physical activity

Optimistic and pessimistic self-assessment of physical activity level was defined by comparing participants' pedometer-measured physical activity with participants' self-assessed activity level. Optimistic self-assessment was defined as participants taking less than 8,000 steps/day and assessing own activity level as moderate or vigorous. Pessimistic self-assessment was defined as participants taking at least 10,000 steps/day and assessing own activity level as sedentary or light (Figure 1). The cut-off points were chosen on the basis of suggested standards (Tudor-Locke & Bassett, 2004; Tudor-Locke et al., 2013; Tudor-Locke, Craig et al., 2011). Taking less than 7,500

steps/day is considered a sedentary/light activity level and less than 7,000-8,000 equivalent not to meet the minimum physical activity recommendation – also defined as inactivity (Tudor-Locke et al., 2013). In Denmark the minimum physical activity recommendation is to be physically active 30 minutes each day. This corresponds to 8,000 steps/day (Tudor-Locke, Craig et al., 2011). Therefore, a cut-off point of 8,000 steps/day was chosen in the present study. According to the same standards (Tudor-Locke & Bassett, 2004; Tudor-Locke et al., 2013; Tudor-Locke, Craig, et al., 2011), a minimum of approximately 10,000 steps/day is considered an active or highly active lifestyle. It was considered not to be reasonable to categorize participants taking 8,000-9,999 steps/day as neither optimistic assessors nor pessimistic assessors. Therefore, it was decided not to include people taking 8,000-9,999 steps/day in the analyses (N=287).

Explanatory variables

In multiple logistic regression models, the effect of variables characterizing socio-demography, health and health behaviour were tested. Information about education and household income, self-rated health and elevated cholesterol, self-assessed diet healthiness, slimming diet and smoking behaviour were obtained in structured face-to-face interviews. Information on gender and age were derived from the Danish Civil Registration System.

Anthropometric measurements

Height, weight and waist circumference were measured by the interviewer using standardized procedures. Weight was measured with an electronic scale (ADE Germany), while wearing light indoor clothing without shoes, belt or sweater and after having emptied the bladder and height was measured with a portable stadiometer (Charder HM200P Portstad) with an accuracy of 0.1 kg and 0.1 cm, respectively. Waist circumference was measured with a tape measure in a horizontal line between the hip bone and the lowest rib and with an accuracy of 1.0 cm. All anthropometric measurements were made twice and an average calculated. BMI was calculated from height and weight. The classification of weight status and abdominal weight status were based on international standards (World Health Organization, 2000).

Statistical analysis

In descriptive analyses group differences were tested using Chi-square test for categorical variables and ANOVA test for continuous variables ($P<0.05$). Results are presented overall and by gender. To account for non-response bias in DANSDA, the presented proportions of optimistic and pessimistic assessors were weighted according to gender, age and education using census data from Statistics Denmark. The presented results of the descriptive analyses, except for study sample characteristics (Table 1), were based on weighted data.

To analyse factors associated with optimistic and pessimistic self-assessments multiple logistic regression models were applied. Results are presented as odds ratios (OR) with 95 % confidence intervals (CI). In the analysis of optimistic self-assessment of physical activity, optimistic assessors

were compared to realistic assessors, and the analysis was conducted among participants taking less than 8,000 steps/day (inactive). In the analysis of pessimistic self-assessment, pessimistic assessors were compared to realistic assessors among participants taking at least 10,000 steps/day (active). All potential explanatory variables of interest were included in the first model: gender, age, educational level and household income, self-rated health, elevated cholesterol, weight status and abdominal weight status, slimming diet, diet healthiness and smoking behaviour. Using backward selection, the least significant variable was removed model by model ($P<0.05$). Gender, age and education were kept in the models as they are known to be associated with the proportion of non-response. Potential interactions between the remaining explanatory variables were tested in the logistic regression model using the same backward selection procedure. The goodness of fit was assessed using Hosmer-Lemeshow goodness of fit.

Sensitivity analyses were conducted in order to examine if different cut-off points affected the proportion of optimistic and pessimistic assessors. Thus, the extent of optimistic self-assessment of physical activity was analysed among participants with less than 7,500 steps/day and among people with less than 8,500 steps/day, while extent of pessimistic self-assessment was analysed among participants with at least 9,500 steps/day and at least 10,500 steps/day. As pedometer data included waking hours and participants' self-assessed activity level refers to leisure time activity, misclassification of pessimistic assessors might occur with a combination of a physically demanding occupation and a sedentary leisure time. In order to examine this issue, sensitivity analyses were conducted. First, in a cross tabulation it was examined if the proportion of pessimistic assessors was larger among participants with a physical demanding occupation compared to participants with a sedentary occupation ($P<0.05$). Second, in order to examine if occupational activity was associated with pessimistic self-assessment of physical activity, a variable on 'occupational occupation' was included in the logistic regression model. The variable classified participants in DANSDA into one of four different levels of occupational activity during the last 12 months: mainly sedentary (sedentary); predominantly standing or walking, but without strenuous work (light); standing or walking with a good deal of lifting or carrying (moderate); heavy or rapid labour (heavy).

All analyses were performed using IBM SPSS Statistics 21.

Results

Study population

Among the 1515 participants in DANSDA recording their steps, 97 were excluded due to incomplete data. Thus, 1418 participants were included in the analysis. In total, 88 % of the participants had 6 or 7 valid days, and 97 % reported their steps at least one weekend day. Further, 76 % reported having their pedometer sealed for all valid days.

The distribution of men and women was 48 % and 52 %, respectively, and the mean age was 47 years for both men and women (Table 1). The mean steps/day including cycling was 9689 (SD 4352). The proportion of participants with <8,000 steps/day was 37 %, and the proportion of participants with ≥10,000 steps/day was 43 % with no gender differences (P>0.332) (data not tabulated). Regarding self-assessed physical activity, 40 % assessed their activity level as moderate or vigorous, 54 % as light and 7 % as sedentary. More men than women assessed their activity level as moderate or vigorous (48 % vs 32 %; P<0,001) (data not tabulated). Among inactive adults, there was a higher number of women and older adults, lower educated and adults with unfavourable health and behavioural characteristic compared to the total sample. Among active, there was a higher number of younger adults, higher educated and adults with favourable health and behavioural characteristics compared to the total sample.

Extent of optimistic and pessimistic assessors

When weighting the data according to the Danish adult population on gender, age and education, the proportion of inactive adults were 39 %, while 41 % were active. Twenty percent took 8,000-9,999 steps/day (data not tabulated).

Among active adults, 27 % were optimistic about their physical activity level (Table 2). Significantly more men were optimistic assessors (32 % vs 22 %; P=0.010). Among active adults, 50 % were pessimistic assessors with significantly more women being pessimistic about their physical activity (56 % vs 45 %; P=0.013). Repeating the analysis with cut-off points plus/minus 500 steps did not affect the proportions significantly (1-2 percentage points; data not shown).

Factors associated with optimistic self-assessment

Optimistic self-assessment was associated with gender and self-rated health (Table 3). Men were more likely to be optimistic about their physical activity than women, and adults with excellent self-rated health were more likely to be optimistic assessors than adults with good or fair/poor self-rated health. A borderline significant association with abdominal weight status (P=0.059) indicated that adults with a healthy abdominal weight status were more likely to be optimistic assessors than adults with abdominal obesity. None of the tested interactions between the explanatory variables proved to be statistically significant.

Factors associated with pessimistic self-assessment

Pessimistic self-assessment was associated with gender, age, education and household income, self-rated health and self-assessed diet healthiness (Table 3). Women were more likely to be pessimistic about their physical activity than men, and 45-64-year-olds were more likely to be pessimistic assessors than 18-44-year-olds. Adults with a basic education and adults with a household income of <250,000 DKK were more likely to be pessimistic assessors than adults with a medium higher education and a household income of ≥800,000 DKK, respectively. Furthermore, adults with good or very good self-rated health were more likely to be pessimistic about their physical activity than adults

with excellent self-rated health. Finally, adults who assessed their diets to be only partly/not at all healthy enough were more likely to be pessimistic assessors than adults who assessed their diets to be healthy enough to a high degree. None of the tested interactions between the explanatory variables proved to be statistically significant.

Discussion

The present study showed that one fourth of inactive Danish adults were optimistic about their physical activity, while half of active adults were pessimistic about their activity. Gender and self-rated health were associated with both optimistic and pessimistic self-assessment of physical activity. Men and adults with excellent self-rated health were more likely to be optimistic assessors, while women and adults with good or very good health were more likely to be pessimistic assessors.

Physical activity is often linked to health substantiated by research indicating that a physically active lifestyle promotes health and prevents non-communicable diseases such as cardiovascular diseases, type 2 diabetes and certain types of cancer (Danish Health Authority, 2011; Haskell et al., 2007; Physical Activity Guidelines Advisoty Committee, 2008; World Health Organization, 2010). Therefore, as pointed out in previous research (Godino et al., 2014; Lechner et al., 2006; van Sluijs et al., 2007; Watkinson et al., 2010), it is reasonable to suggest that people might conclude the reverse, that favourable health characteristics are indicators of being sufficiently physically active. Our results support this hypothesis. Only two of the previous published studies examined the association between gender and optimistic and pessimistic self-assessments (Godino et al., 2014; Watkinson et al., 2010). Godino et al. (2014) reported a significant association supporting the results of the present study that men are more likely to be optimistic about their physical activity level. According to Godino et al. (2014) it may reflect the gender stereotype that men are stronger and fitter and thus more “physical” overall. The findings of men being optimistic in their self-assessment are in line with studies showing that overweight men were more likely than women to assess their weight status optimistically (Matthiessen et al., 2013). According to self-regulation theory, people compare their behaviours to a standard (van Sluijs et al., 2007). Lechner et al. (Lechner et al., 2006) found that people who were optimistic about their physical activity level more often compared themselves with people who were less or equally physically active and less healthy and vice versa. Maybe men are more likely to use downward comparison, while women are more likely to use upward comparison – maybe due to more strict cultural norms for women’s weight status (Yaemsiri et al., 2011).

In previous studies, the extent of optimistic assessors among inactive varied between 46 % and 61 % (Godino et al., 2014; Lechner et al., 2006; Ronda et al., 2001; van Sluijs et al., 2007; Watkinson et al., 2010). The extent of pessimistic assessors was only outlined among active individuals in one of the previous studies, and it was found to be 36 % (Godino et al., 2014). The comparable proportions in the present study were 27 % and 50 %, respectively. It has been suggested that public focus on a health

behaviour increases people's awareness of their own behaviour (Glanz et al., 1997). The lower proportion of optimistic self-assessment in the present study might be due to health promotion initiatives in Denmark emphasizing the importance of physical activity (Danish Cyclists' Foundation, 2016; Ministry of Transport, 2014). As the studies vary in measures and cut-off points, in definitions of self-assessment groups and in methods of measurement, these differences are also likely to affect the different proportions of optimistic and pessimistic self-assessment. In order to discuss what might explain the different proportions and to discuss what might be behind the identified associations with health characteristics and gender, more in-depth knowledge is needed.

Strengths and limitations

A strength of the present study is the use of a nationwide random sample that enables generalizability of the results to the general adult population. A limitation is the response rate of 52 % as non-response bias may occur. The weighting of data is a strength. However, it cannot fully substitute for non-response. For example, studies have found that non-respondents are likely to have more unfavourable health and lifestyle characteristics (Christensen et al., 2015; Nyholm et al., 2008), and the findings of the present study should therefore be evaluated in this light.

Another strength of this study was the use of an objective measure of physical activity in contrary to most of the previously published studies in this area (Jansink et al., 2012; Lechner et al., 2006; Ronda et al., 2001; van Sluijs et al., 2007). Objective measures eliminate the risk of recall bias and minimizes the risk of social desirability bias (Sallis & Saelens, 2000). The pedometer used is one of the most accurate electronic pedometers and suitable for research in free-living conditions in large populations (Schneider et al., 2004). The potential limitations, including non-ambulatory activities and risk of reactivity, were compensated for by inclusion of step equivalents for cycling and sealing of the pedometers. It is recognized that pedometers do not measure intensity but studies have shown that steps per day may explain 65 % of the variation in time spent in moderate to vigorous activities according to accelerometry measures (Tudor-Locke, Johnson et al., 2011).

The cut-off points defining inactive (<8,000 steps/day) and active (≥10,000 steps/day) adults are substantiated in relevant literature (Tudor-Locke & Bassett, 2004; Tudor-Locke et al., 2013; Tudor-Locke, Craig et al., 2011). Internationally, the guidelines recommending adults to engage in minimum 30 minutes moderate to vigorous activity per day are widely accepted and a reasonable approximation of this activity is considered to be a minimum of approximately 3000 steps/day (Tudor-Locke, Craig et al., 2011). The activity should be over and above the usual daily activities, and a reasonable approximation of this activity is considered to be approximately 5000 steps/day. Therefore, a minimum of approximately 8,000 steps/day is considered equivalent to meeting the minimum physical activity recommendation. Taking a minimum of approximately 10,000 steps/day is a reasonable goal for healthy adults and is associated with indicators of good health (Tudor-Locke & Bassett, 2004; Tudor-Locke, Craig et al., 2011). Nonetheless, the exact cut-off values are approximations of a complex translation of the physical activity recommendation into daily steps and therefore inevitably subject to

some level of uncertainty. It is a strength that sensitivity analyses of cut-off points plus/minus 500 steps/day did not show any significant difference in the proportion of optimistic and pessimistic assessors, respectively (data not shown). Participants with 8,000-9,999 steps/day were not included in the analyses as it was considered not to be reasonable to categorise them as either optimistic or realistic assessors with the measure of self-assessed physical activity available. The exclusion of participants taking 8,000-9,999 steps/day in the analyses may be considered a limitation of the study.

In the present study, there were two limitations due to differences between the pedometer-measured physical activity and the self-assessed physical activity. First, the reference period differed between the two measurements. Pedometer data measured participants' physical activity during seven consecutive days, while participants assessed their leisure-time activity level during the last year. Therefore, the reference period for pedometer-measured physical activity may not be representative the self-assessed physical activity. In DANSDA 2011-2013, 64 % reported that their physical activity level in the registration period corresponded to their habitual activity level (unpublished data from DANSDA 2011-2013). It cannot be excluded that the remaining 36 % were misclassified on this basis, and the findings should be evaluated in this light. Second, pedometer data included activity in hours awake, while the self-assessed data included leisure time activity. This may result in misclassifications if people's classification as active or highly active mainly was based on steps taken during their working hours. However, we did not find significant differences in the proportion of pessimistic assessors in the different occupational activity levels (data not shown). Furthermore, when occupational activity was included in the regression model, the variable was not associated with pessimistic self-assessment. Therefore, we do not consider this as affecting our conclusions.

Conclusions

The present study showed that one fourth of Danish adults defined as inactive were optimistic about their physical activity level, while half of adults defined as active were pessimistic about their activity level. Gender and self-rated health were associated with both optimistic and pessimistic self-assessment of physical activity. Men and adults with excellent self-rated health were more likely to be optimistic assessors, while women and adults with good or very good health were more likely to be pessimistic assessors. Future public health initiatives should address especially optimistic self-assessments among men because these men may not be aware of their degree of inactivity. The results of this study suggest a need to promote health benefits of physical activity regardless of present health status and to clarify to the general population that health status is not always an indicator of sufficiently or insufficiently physical activity.

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Countributorship

MRS, IT, EWA and JM conceived, designed and planned the study and data analysis. JM was responsible for the quality control of the pedometer data. MRS conducted the statistical analysis with supervision from EWA, and MRS wrote the manuscript. MRS, IT, EWA and JM all participated in the interpretation of the data and the critical revision of the manuscript, and all authors read and approved the final manuscript.

Conflict of interests

The authors declare that there is no conflict of interests.

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Tables and figure

Table 1. Characteristics of the entire sample and of inactive (<8,000 steps/day) and active (≥10,000 steps/day) participants

	All N=1418	<8,000 steps/day N=526	≥10,000 steps/day N=605
Socio-demography			
Gender (%, N)			
Men	47.6 (675)	46.2 (243)	49.1 (297)
Women	52.4 (743)	53.8 (283)	50.9 (308)
Age groups, years (%, N)			
18-24	10.2 (144)	7.8 (41)	12.1 (73)
25-44	32.9 (467)	23.6 (124)	39.3 (238)
45-64	40.7 (577)	42.2 (222)	39.0 (236)
65-75	16.2 (230)	26.4 (139)	9.6 (58)
Age, years (mean, SD)	47.2 (15.6)	51.8 (15.8)	44.0 (14.8)
Educational level (%, N), N=1408			
Basic school	12.9 (181)	18.2 (95)	8.3 (50)
Upper secondary school	7.4 (104)	6.7 (35)	8.3 (50)
Vocational	38.7 (545)	40.6 (212)	36.7 (220)
Short higher	8.0 (113)	7.1 (37)	8.8 (53)
Medium higher	20.7 (292)	17.4 (91)	23.3 (140)
Long higher	12.3 (173)	10.0 (52)	14.5 (87)
Household income[a], DKK (%, N), N=1298			
<250.000	17.9 (232)	24.2 (115)	15.4 (86)
250.000-399.999	19.5 (253)	21.5 (102)	18.9 (105)
400.000-599.999	21.1 (274)	22.3 (106)	19.2 (107)
600.000-799.999	21.7 (282)	15.4 (73)	24.4 (136)
≥800.000	19.8 (257)	16.6 (79)	22.1 (123)
Health behaviour			
Steps/day (mean, SD)	8367 (3482)	5285 (1705)	11126 (3043)
Cycling in steps/day (mean, SD)	1322 (2278)	264 (675)	2522 (2917)
Steps/day incl. cycling (mean, SD)	9689 (4352)	5549 (1696)	13648 (3296)
Steps/day incl. cycling, categorical (%, N)			
<8,000 steps/day incl. cycling (%, N)	37.1 (526)	100 (526)	-
8,000-9,999 steps/day incl. cycling (%, N)	20.2 (287)	-	-
≥10,000 steps/day incl. cycling (%, N)	42.7 (605)	-	100 (605)
Self-assessed PA level, leisure time (%, N), N=1406			
Vigorous	5.7 (80)	3.3 (17)	8.2 (49)
Moderate	34.4 (483)	24.0 (125)	42.7 (256)
Light	53.5 (752)	61.2 (319)	46.8 (281)
Sedentary	6.5 (91)	11.5 (60)	2.3 (14)
Self-assessed diet healthiness (%, N), N=1417			
High degree	24.4 (346)	22.7 (119)	27.6 (167)
Some degree	51.5 (730)	45.9 (241)	53.9 (326)
Partly/Not at all	24.1 (341)	31.4 (165)	18.5 (112)
Smoking behaviour (%, N), N=1406	20.8 (293)	26.3 (137)	16.2 (97)
Slimming diet (%, N), N=1407			
No	58.6 (825)	54.2 (283)	63.3 (380)
Yes, now	6.3 (89)	8.0 (42)	4.7 (28)
Yes, within the last year	11.0 (155)	11.1 (58)	10.0 (60)
Yes, more than one year ago	24.0 (338)	26.6 (139)	22.0 (132)
Health			
Weight status (%, N), N=1348			
Normal weight (BMI <25)	42.9 (578)	28.8 (141)	54.8 (322)
Overweight (BMI 25 - <30)	40.5 (546)	46.7 (229)	35.5 (209)
Obese (BMI ≥30)	16.6 (224)	24.5 (120)	9.7 (57)
Abdominal weight status (%, N), N=1333			
Healthy[b]	41.8 (557)	25.9 (125)	55.4 (321)
Abdominal overweight[c]	26.3 (350)	26.3 (127)	25.6 (148)
Abdominal obesity[d]	32.0 (426)	47.8 (231)	19.0 (110)
Elevated cholesterol, N=1410	12.4 (175)	18.7 (98)	7.5 (45)
Self-rated health (%, N), N=1407			
Excellent	23.8 (335)	17.4 (91)	28.5 (171)
Very good	38.7 (545)	33.1 (173)	43.5 (261)
Good	30.1 (424)	37.0 (193)	24.8 (149)
Fair/poor	7.3 (103)	12.5 (65)	3.2 (19)

[a] 7.45 Danish kroner = 1 Euro

[b] Men: <94 cm; women: <80 cm

[c] Men: 94-101 cm; women: 80-87 cm
[d] Men: ≥102 cm; women: ≥88 cm

Table 2. Optimistic and realistic self-assessment among inactive adults and pessimistic and realistic self-assessment among active adults. Percentages

	All	Men	Women	P-value*
Inactive (n=526)				0.010
Optimistic assessors	27	32	22	
Realistic assessors	73	68	78	
Active (n=605)				0.013
Pessimistic assessors	50	45	56	
Realistic assessors	50	55	44	

* Gender differences. Tested using Chi-square test (P<0.05)

Table 3. Odds Ratios (OR, 95% CI) for optimistic self-assessment of physical activity level among inactive participants (<8,000 steps/day incl. cycling[a]) (outcome variable: optimistic vs realistic assessors) (N=517[b])

		OR	95% CI	P-value[c]
Gender				
	Men	1.00		
	Women	**0.45**	**0.29-0.68**	**<0.001**
Self-rated health				**<0.001**
	Excellent	1.00		
	Very good	0.66	0.38-1.14	0.134
	Good	**0.36**	**0.20-0.64**	**<0.001**
	Fair/poor	**0.15**	**0.06-0.38**	**<0.001**
Abdominal weight status				0.059
	Healthy	1.00		
	Abdominal overweight	0.58	0.32-1.04	0.066
	Abdominal obesity	**0.52**	**0.32-0.92**	**0.023**

[a] Included factors: gender, age, educational level, household income, weight status, abdominal weight status, elevated cholesterol, self-rated health, slimming diet, self-assessed diet healthiness, smoking behaviour. Gender, age and education were kept in the model
[b] Optimistic assessors n=142, realistic assessors n=379, missing data n=4
[c] Tested using logistic regression (P<0.05)

Table 4. Odds Ratios (OR, 95% CI) for pessimistic self-assessment of physical activity among active participants (≥10,000 steps/day incl. cycling[a]) (outcome variable: pessimistic vs realistic assessors) (N=554[b])

		OR	95% CI	P-value[c]
Gender				
	Men	1.00		
	Women	**2.10**	**1.44-3.06**	**<0.001**
Age				**0.008**
	18-24	**0.37**	**0.17-0.83**	**0.016**
	25-44	**0.52**	**0.34-0.79**	**0.002**
	45-64	1.00		
	65-75	0.71	0.36-1.41	0.330
Education				**0.003**
	Basic school	1.00		
	Upper secondary school	0.38	0.14-1.03	0.057
	Vocational	0.91	0.41-2.00	0.808
	Short higher	0.77	0.30-2.00	0.595
	Medium higher	**0.40**	**0.17-0.92**	**0.031**
	Long higher	1.12	0.46-2.72	0.809
Household income (DDK)				**0.035**
	<250.000	1.00		
	250.000-399.999	0.74	0.39-1.42	0.361
	400.000-599.999	0.58	0.30-1.14	0.113
	600.000-799.999	0.60	0.31-1.15	0.121
	≥800.000	**0.34**	**0.17-0.68**	**0.002**
Self-rated health				**0.002**
	Excellent	1.00		
	Very good	**1.91**	**1.22-2.98**	**0.005**
	Good	**2.59**	**1.55-4.33**	**<0.001**
	Fair/poor	2.84	0.91-8.88	0.074
Self-assessed diet healthiness				**0.002**
	High degree	1.00		
	Some degree	0.96	0.62-1.48	0.855
	Partly/Not at all	**2.37**	**1.33-4.24**	**0.004**

[a] Included factors: gender, age, educational level, household income, weight status, abdominal weight status, elevated cholesterol, self-rated health, slimming diet, self-assessed diet healthiness, smoking behaviour. Gender, age and education were kept in the model

[b] Pessimistic assessors n=295, realistic assessors n=305, missing data n=46

[c] Tested using logistic regression (P<0.05)

		Self-assessed physical activity level	
		Moderate/vigorous	Light/sedentary
Pedometer-determined physical activity	<8,000 steps/day	Optimistic assessors	Realistic assessors
	≥10,000 steps/day	Realistic assessors	Pessimistic assessors

Figure 1. Classification of optimistic, realistic and pessimistic assessors of physical activity

Paper II

Optimistic and pessimistic self-assessment of own diets is associated with age, self-rated health and weight status in Danish adults

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Abstract

The aim of this study was to examine the extent to which Danish adults assess the healthiness of their own diets optimistically and pessimistically and further, to examine socio-demographic, health and behavioural characteristics associated with such optimistic and pessimistic self-assessment.

Data were derived from The Danish National Survey of Diet and Physical Activity 2011-2013 and included a random sample of 3014 adults (18-75 y). Diet quality was evaluated on the basis of seven-day pre-coded food diaries. A validated diet index score was applied to categorise individuals' diets in unhealthy, somewhat healthy, and healthy diets. Self-assessed diet healthiness was measured with a question included in a structured face-to-face interview. Optimistic and pessimistic self-assessment was defined by comparing individuals' estimated diet quality with individuals' self-assessed diet healthiness. Multiple logistic regression models were used to examine characteristics associated with optimistic and pessimistic self-assessments, respectively.

Among individuals with unhealthy diets, 13 % were highly optimistic about the healthiness of their diets, 42 % were somewhat optimistic and 45 % were realistic. Among individuals with healthy diets, 14 % were highly pessimistic about the healthiness of their diets, 51 % were somewhat pessimistic and 35 % realistic. Highly optimistic self-assessment was associated with increasing age, excellent self-rated health, normal weight and a moderate activity level. Highly pessimistic self-assessment was associated with decreasing age, good self-rated health and being overweight or obese. Favourable health characteristics associated with optimistic self-assessment suggest a need for increasing the knowledge of adverse health effects of unhealthy diets, and promoting health benefits of healthy diets, regardless of present health and weight status.

Keywords

Estimated diet quality, diet index, self-assessed diet healthiness, cross-sectional study, random sample, adults

Introduction

The association between diet and health is well-established (Nordic Council of Ministers, 2014; Tetens et al., 2013; World Cancer Research Fund/American Institute for Cancer Research, 2007; World Health Organization, 2003). Accordingly, food and health authorities in Denmark and other Western countries outline evidence-based dietary guidelines (Danish Veterinary and Food Administration, 2013; Dietary Guidelines Advisory Committee, 2015; Food and Agriculture Organization of the United Nations, 2016). In order to promote healthier diets among populations, action plans are completed and several initiatives implemented at various levels (Danish Veterinary and Food Administration, 2016; Nordic Council of Ministers, 2006; Research Centre for Prevention and Health, 2009; World Health Organization, 2015). However, compliance with food-based dietary guidelines (FBDG) remains low (Amcoff et al., 2012; Pedersen et al., 2015; Rossum et al., 2011; Totland et al., 2012). In the Danish adult population, 97 % do not comply with the recommendation for saturated fat (≤10 E%), 83 % do not comply with the recommendation for fruit and vegetables (600 gr/10 MJ/day), and 33 % eat more than the recommended maximum intake of sugar (≤10 E%) (Pedersen et al., 2015).

Concurrently, results from the Danish National Survey of Diet and Physical Activity 2005-2008 showed that 79 % of Danish adults considered their diets to be healthy enough, and 80 % believed that they ate enough vegetables (Groth et al., 2009). Among adults who believed they ate enough vegetables, 78 % had a vegetables intake below the recommended amount (Sørensen et al., 2013). Thus, there seems to be considerable differences between Danish adults' compliance with Danish FBDG and Danish adults' self-assessments of the healthiness of their own diets.

Previous studies found that people who assessed the healthiness of their diets optimistically were less likely to intend changing to healthier eating behaviours (Brug et al., 1994; Jansink et al., 2012; Lechner et al., 1997; Variyam et al., 2001), and it was suggested that optimistic self-assessment is a potential barrier in the promotion of healthier diets. Studies have found that 27-42 % assessed the healthiness of their dietary intake optimistically (Brug et al., 1994; Glanz et al., 1997; Jansink et al., 2012; Lechner et al., 1997; Variyam et al., 2001), while 20-28 % assessed the healthiness of their dietary intake pessimistically. The association between optimistic self-assessment and intention to change was typically explained by referring to the Precaution Adoption Process Model (Weinstein, 1988). According to this model, people need to be aware that their behaviour is a potential health risk in order to be motivated to initiate a behaviour change process.

Several studies conclude that an important step in health promotion initiatives is to make people aware of their unhealthy diets (Brug et al., 1994; Jansink et al., 2012; Lechner et al., 1997; Variyam et al., 2001). The complexity in assessing dietary intake has been suggested to explain lack of awareness of unhealthy diets (Brug et al., 1994; Dijkstra et al., 2014; Variyam et al., 2001), and feedback on people's dietary intake has been suggested as a potential strategy for making people aware of their unhealthy diets (Brug et al., 1994; Glanz et al., 1997; Lechner et al., 1997). One study

suggests that lay people's self-assessments are influenced by their knowledge about healthy diets (Lechner et al., 1997) and increasing the knowledge about FBDG would support more realistic self-assessments. However, potential reasons for optimistic self-assessments have not been explored in-depth, and the suggested solutions – making people aware of their unhealthy diets or increasing the knowledge about FBDG – seem speculative.

Studies about people's optimistic and pessimistic self-assessment of the healthiness of their dietary intake have been conducted in only two countries. Most of the studies are conducted in the Netherlands (Brug et al., 1994; Dijkstra et al., 2014; Jansink et al., 2012; Lechner et al., 1997), while the study of Glanz et al. (1997) also included data from the US, and the study of Variyam et al. (2001) was conducted in the US. Furthermore, the majority of the studies included only few food or nutrient components (Brug et al., 1994; Dijkstra et al., 2014; Glanz et al., 1997; Jansink et al., 2012; Lechner et al., 1997). The study by Variyam et al. (Variyam et al., 2001) examined overall diet quality and argued that examining only one or two dietary components may not be used to generalize to people's assessment of the healthiness of the total diet. Most of the studies were conducted in specific populations such as patients with type 2 diabetes (Jansink et al., 2012), older people (Dijkstra et al., 2014), meal planners/preparers of households (Variyam et al., 2001) or in local communities (Brug et al., 1994; Glanz et al., 1997). As FBDG and other national public health initiatives are targeted the general population, it is important to study the phenomenon of optimistic and pessimistic self-assessment in the general population.

The present study is the first of three studies comprising a mixed method study. The first two studies examined the extent to which Danish adults (18-75 y) were optimistic and pessimistic about their physical activity level and the healthiness of their diets. Further, the studies examined socio-demographic, health and behavioural characteristics associated with optimistic and pessimistic self-assessments, respectively. The third study was a qualitative study exploring considerations underlying lay people's self-assessment of unhealthy diets (Sørensen & Holm, 2016). Examining criteria underlying lay people's self-assessment in depth as well as in width is likely to bring about a more complete picture of the phenomenon (Bryman, 2006; Greene et al., 1989; Padgett, 2012). This knowledge is likely to be valuable in future health promotion initiatives.

The aim of the present study was to examine the extent to which Danish adults assess the healthiness of their own diets optimistically and pessimistically and further, to examine socio-demographic, health and behavioural characteristics associated with such optimistic and pessimistic self-assessment.

Material and methods

Study design

Data were derived from The Danish National Survey of Diet and Physical Activity 2011-2013 (DANSDA). DANSDA is a nationwide, cross-sectional survey where data on diets, physical activity, weight status and health-related lifestyle factors were collected in a nationwide random sample of the Danish population from spring 2011 to summer 2013. Data were collected with seven-day pre-coded food diaries and pedometer step counts, measured anthropometrics and structured face-to-face interviews (socio-demography and health-related lifestyle). A sample of 7,253 individuals (4-75 y) were drawn from the Danish Civil Registration System (Pedersen, 2011) and 3,946 (54 %) participated with valid data (Pedersen et al., 2015). Hereof, 3,016 were adults aged 18-75 years. Among this group the response rate was 52 %. In order to ensure sufficient language knowledge, individuals who did not speak Danish were excluded from the random sample. Furthermore, to ensure sufficient knowledge about dietary intake, disabled individuals, nursing home residents and home-dwelling individuals receiving meals from outside their homes regularly were excluded from the random sample (Pedersen et al., 2015). Compared to the Danish population, individuals with basic education were underrepresented, while men and 19-54-year-olds were slightly underrepresented (Pedersen et al., 2015).

DANSDA was conducted in accordance with the Declaration of Helsinki and approved by the Danish Data Protection Agency. The Danish National Committee on Health Research Ethics has reviewed the study protocol and reported that DANSDA did not require approval by this authority according to Danish Law.

Measures

Estimated diet quality

Participants recorded their dietary intake in pre-coded food diaries for seven consecutive days (Biltoft-Jensen et al., 2009; Pedersen et al., 2015). The food diary was structured according to a typical Danish meal pattern (breakfast, lunch, dinner and in-between meals) and included the most commonly eaten foods and drinks with an opportunity to add food and drinks not included in the pre-codes. Portion size was estimated using household measures (cups, glasses etc.) and photographs in a booklet containing a series of 41 photographs with 6 different portion sizes. Intakes of energy, nutrients and food items were calculated for each individual using the software system GIES version 1.000.i6 (developed at the National Food Institute, Technical University of Denmark, Søborg, Denmark) and the Danish Food Composition Databank version 7.0 (National Food Institute Technical Unversity of Denmark, 2009).

The overall diet quality of each individual was evaluated by means of a diet index score based on five food and nutrient guidelines from the Danish FBDG 2013: energy from saturated fat (max 10 E%),

energy from added sugar (max 10 E%), intake of fruits and vegetables (600 g/10 MJ/day), intake of fish (350 g/10 MJ/week) and intake of wholegrain (min 75 g/10 MJ/day) (Tetens et al., 2013). The diet index was a slightly modified version of a validated diet index based on the Danish FBDG 2005 (Knudsen et al., 2012). For each individual, a score between 0 and 1 was calculated according to the compliance with each of the five guidelines included in the index. The total score was calculated as the sum of the five scores, ranging from 0 to 5 where 0 was most far from the dietary guidelines and 5 was compliance with all five dietary guidelines.

To distinguish individuals with low, intermediate and high diet quality, individuals were divided in tertiles according to the total diet index score. This was in accordance with previous studies (Brug et al., 1994; Glanz et al., 1997). A diet with a diet index score in the lowest tertile was defined as unhealthy. This corresponds to a diet index score between 0.3 and 3.0. A diet with a diet index score in the highest tertile was defined as healthy, corresponding to a diet index score between 3.8 and 5.0. The intermediate diet index score was defined as a somewhat healthy diet. Thus, the categorization was relative, and healthy diets were not necessarily equivalent to complying with all the guidelines. Less than 1 % complied with all five guidelines and therefore it was not a relevant cut-off point for distinguishing healthy and unhealthy diets.

Self-assessed diet healthiness

Information about self-assessed diet healthiness was obtained with the following question: Do you consider your dietary habits to be healthy enough? The question was part of a structured face-to-face interview conducted by trained interviewers before participants recorded their diets. The response categories were: (1) Yes, to a high degree; (2) Yes, to some degree; (3) No, only partly; and (4) No, not at all. Due to low numbers in the last category (5.2 %), category 3 and 4 were merged.

Definition of optimistic and pessimistic self-assessment of diet healthiness

Optimistic self-assessment was defined as having a diet index score in the lowest third of the total diet index (unhealthy diets) and at the same time assessing own diets as healthy to a high degree (highly optimistic) or to some degree (somewhat optimistic). Pessimistic self-assessment was defined as having a diet index score in the highest third of the total diet index (healthy diets) and at the same time assessing own diets as not at all/only partly healthy enough (highly pessimistic) or to some degree healthy enough (somewhat pessimistic).

Socio-demographic, health and lifestyle characteristics

Information about education and household income, self-rated health and elevated cholesterol, slimming diet, physical activity level and smoking behaviour were obtained in structured face-to-face interviews. Information on gender and age were derived from the Danish Civil Registration System (Pedersen, 2011).

Anthropometric measurements

Height, weight and waist circumference were measured by the interviewer using standardized procedures. Weight was measured with an electronic scale (ADE, Germany) while wearing light indoor clothing, and height was measured with a portable stadiometer (Charder HM200P Portstad) with an accuracy of 0.1 kg and 0.1 cm, respectively. Waist circumference was measured with a tape measure in a horizontal line between the hip bone and the lowest rib and with an accuracy of 1.0 cm. All anthropometric measurements were made twice and an average calculated. BMI was calculated as weight (kg)/height $(m)^2$. The classification of weight status and abdominal weight status was based on international standards (World Health Organization, 2000).

Statistical analyses

In descriptive analyses group differences were tested using Chi-square test for categorical variables and ANOVA test for continuous variables ($P<0.05$). Results are presented overall and by gender. To account for non-response bias in DANSDA, the presented proportions of optimistic and pessimistic assessors were weighted according to gender, age and education using census data from Statistics Denmark. The results of the descriptive analyses, except for study sample characteristics (Table 1), were based on weighted data. Sensitivity analyses were conducted in order to examine if different cut-off points affected the proportions of optimistic and pessimistic assessors. Thus, the extent of optimistic self-assessment was analysed among the quartile with the lowest diet index score and the extent of pessimistic self-assessment was analysed among the quartile with the highest diet index score.

To analyse factors associated with optimistic and pessimistic self-assessments multiple logistic regression models were used. Results are presented as odds ratios (OR) with 95 % confidence intervals (CI). In the analysis of optimistic self-assessment of diet healthiness, highly optimistic assessors were compared with realistic assessors, and the analysis was conducted among participants with a low diet index score. In the analysis of pessimistic self-assessment of diet healthiness, highly pessimistic assessors were compared with realistic assessors, and the analysis was conducted among participants with a high diet index score. Somewhat optimistic and somewhat pessimistic assessors, respectively, were not included in the outcome, due to a risk of misclassifying participants as optimistic or pessimistic assessors based on the response that they consider their diets to some degree healthy enough. However, sensitivity analyses were performed where somewhat optimistic assessors and somewhat pessimistic assessors, respectively, were included in the outcome.

All potential explanatory variables of interest were included in the first model: gender, age, educational level and household income, self-rated health, elevated cholesterol, weight status and abdominal weight status, slimming diet, leisure time physical activity and smoking behaviour. Using backward selection, the least significant variable was removed model by model ($P<0.05$). Gender, age and education were kept in the models as they are known to be associated with the proportion of non-

response (Pedersen et al., 2015). Potential interactions between the remaining explanatory variables were tested in the logistic regression model using the same backward selection procedure. The goodness of fit was assessed using Hosmer-Lemeshow goodness of fit. All analyses were performed using IBM SPSS Statistics 21.

Results

Study population

Valid interview and dietary intake data were available from 3014 participants aged 18-75 years. Characteristics of the study population are shown in Table 1. The mean diet index score was 3.3. Twenty five percent considered their diets to be healthy enough to a high degree, 51 % to some degree, and 24 % considered their diets not be healthy enough. Among adults with unhealthy diets, there were a higher number of men and younger adults, lower educated and adults with unfavourable health and behavioural characteristic compared to the total sample. Among adults with healthy diets, there were a higher number of women and older adults, higher educated and adults with favourable health and behavioural characteristics compared to the total sample.

Extent of optimistic and pessimistic assessors

When weighting the data according to the Danish adult population on gender, age and education, the proportion of adults with unhealthy diets was 40 %, 32 % had somewhat healthy diets, while 28 % had healthy diets (data not tabulated).

Among adults with unhealthy diets, 13 % were highly optimistic about the healthiness of their diets, 42 % somewhat optimistic and 45 % were realistic about their unhealthy diets (Table 2). Among adults with healthy diets, 14 % were highly pessimistic about the healthiness of their diets, 51 % somewhat pessimistic and 35 % were realistic about their healthy diets. In the entire sample, 29 % were optimistic about the healthiness of their diets (5+17+7), while 26 % were pessimistic (8+14+4), and 46 % (10+18+18) were found to be realistic assessors (Figure 1). The sensitivity analyses with different cut-off points (quartiles) did not change the proportions of optimistic and pessimistic self-assessments significantly (data not shown).

Factors associated with optimistic and pessimistic self-assessment of diet healthiness

Among adults with unhealthy diets, highly optimistic self-assessment was associated with age, self-rated health, weight status and physical activity level (Table 3). Thus, 65-75-year-olds were more likely to be optimistic about their unhealthy diets than 45-64-year-olds (OR 2.84 (1.42; 5.69)), and 18-44-year-olds were less likely to be optimistic assessors (18-24 y: OR 0.05 (0.02; 0.15) and 25-44 y: OR 0.14 (0.07; 0.27), respectively). Individuals with excellent self-rated health were more likely to be optimistic assessors compared with those with very good or good self-rated health (OR 0.34 (0.17;

0.65) and 0.36 (0.19; 0.69), respectively), and normal weight individuals were more likely to be optimistic assessors than overweight or obese individuals (OR 0.11 (0.05; 0.24) and 0.40 (0.23; 0.71) respectively). Finally, individuals with a moderate physical activity level were more likely to be optimistic assessors than individuals with a light or sedentary physical activity level (OR 0.36 (0.15; 0.83) and 0.48 (0.27; 0.85), respectively). None of the tested interactions between the explanatory variables proved to be statistically significant.

In the sensitivity analysis of factors associated with somewhat and highly optimistic self-assessment, the overall findings were the same (data not shown). However, self-rated health was no longer significantly associated with optimistic self-assessment.

Among adults with healthy diets, highly pessimistic self-assessment was associated with age, self-rated health and weight status (Table 4). Thus, 25-44-year-olds were more likely to be pessimistic about the healthiness of their diets than 45-64-year-olds (OR 2.78 (1.52; 5.08)), while 65-75-year-olds were less likely to be pessimistic assessors (OR 0.48 (0.24; 0.95)). Further, individuals with good self-rated health were more likely to be pessimistic assessors compared with those who had an excellent self-rated health (OR 3.59 (0.17; 0.65)) and obese individuals were more likely to be pessimistic assessors compared to normal weight individuals (OR 3.75 (1.82; 7.73)). In addition, physical activity level was borderline significantly associated with pessimistic self-assessment, indicating that adults with sedentary activity level were more likely to be pessimistic assessors (P=0.068). None of the tested interactions between the explanatory variables proved to be statistically significant.

In the sensitivity analysis of factors associated with somewhat and highly pessimistic self-assessment, the overall findings were the same (data not shown). However, some of the findings were less marked when somewhat pessimistic assessors were included in the outcome. Additionally, slimming diet and leisure time physical activity was significantly associated with pessimistic self-assessment.

Discussion

In this representative sample of the Danish adult population, we found that just above half of Danish adults with unhealthy diets were optimistic assessors of their own diets. Furthermore, two out of three adults with healthy diets were pessimistic assessors of their own diets. Increasing age and favourable health characteristics were found to be associated with optimistic self-assessments, while decreasing age and less favourable heath characteristics were associated with pessimistic self-assessments.

The results indicate that people might use personal health characteristics as important references when assessing the healthiness of their diets. Thus, feeling healthy and looking healthy may function as significant signs of healthy eating behaviours, while feeling less healthy and being obese may function as signs of unhealthy eating behaviours. This interpretation has previously been suggested by

studies examining associations between health characteristics and optimistic self-assessment of physical activity (Godino et al., 2014; Lechner et al., 2006; van Sluijs et al., 2007; Watkinson et al., 2010). The qualitative study (Sørensen & Holm, 2016) that followed the present study explored considerations underlying lay people's self-assessment of unhealthy diets, and the findings support this interpretation. Thus, perceptions of a healthy weight and wellbeing were found to be decisive criteria when interviewees assessed the healthiness of their diets optimistically. Furthermore, the qualitative study suggested that – besides from overweight – concerns about gaining weight or previous experiences with gaining or losing weight seemed to support a more realistic assessment of unhealthy diets. Another qualitative study supports the finding of individuals relying on feedback from their own body when considering eating a healthier diet or becoming more physically active (Bukman et al., 2014).

Previous findings of socio-demographic characteristics of optimistic and pessimistic assessors are not consistent. Variyam et al. (2001) found that men were more likely to be optimistic assessors, while Glanz et al. (1997) found that women were more likely to be optimistic assessors. In accordance with the present study, Dijkstra et al. (2014) found no association with gender. Contrary to our findings, none of the previous studies found age to be associated with optimistic or pessimistic self-assessment of diet healthiness (Dijkstra et al., 2014; Glanz et al., 1997; Variyam et al., 2001). This may be due to a more narrow age span compared to the one in the present study (Dijkstra et al., 2014; Glanz et al., 1997). Furthermore, the study of Dijkstra et al. (2014) found lower education to be associated with optimistic self-assessments. The studies of Glanz et al. (1997) and Variyam et al. (2001) support this finding, however with a less clear trend. The various studies differ in study populations, and the outcome varies between overall diet quality and intake of single food items. Further, the studies vary in measures and cut-off points, in definitions of self-assessment groups, and in assessment methods. Therefore, one explanation of the inconsistent findings is likely to be methodological differences between the studies.

Also the extent of optimistic and pessimistic self-assessments varies between the different studies. Previous studies found that 27-42 % (Brug et al., 1994; Glanz et al., 1997; Lechner et al., 1997; Variyam et al., 2001) and 2-19 % (Dijkstra et al., 2014) were optimistic assessors, while 20-28 % (Glanz et al., 1997; Variyam et al., 2001) and 1-16 % (Dijkstra et al., 2014) were pessimistic assessors. Extent of optimistic and pessimistic assessors was calculated as the percentage of all participants. In the present study, this was found to be 29 % for optimistic assessors and 26 % for pessimistic assessors. The only other study examining overall diet quality found that 40 % were optimistic about their diet quality (Variyam et al., 2001). The same study found a decrease in the proportion of optimists when estimating the extent of optimistic self-assessment of four individual nutrients in the period from 1989-1990 to 1994-1996. It was hypothesized that the proportion related to the overall diet quality would also decrease with time. The relatively low proportion of optimistic assessors identified in the present and recent study supports this. Variyam et al. (2001) suggested

that a decrease could be due to policy changes such as nutrition labels. Glanz et al. (1997) emphasized that the more focus in the public on fat intake, the more awareness on own intake and thereby more realistic self-assessments. The lower proportion of optimistic assessors in the present study compared to older studies might be influenced by an increased focus on health and healthy lifestyles today than 20 years ago. Various methodological differences between the studies are also likely to explain some of the differences, why comparisons should be made with caution.

It is worth noting that a relatively high proportion of the participants in the presents study were realistic about their unhealthy diet (45 %). According to the Precaution Adoption Process Model, awareness of own risk behaviour is an important precondition for being motivated to change the behaviour (Weinstein, 1988). Therefore, as mentioned in the introduction, making people aware of their unhealthy diets has been suggested as an important first step in the promotion of healthier diets, and personal feedback on dietary intake has been suggested as a strategy. The findings of the present study, along with the findings of the qualitative study (Sørensen & Holm, 2016), add to these suggestions. The qualitative study showed that lay people might be well aware of unhealthy diets (Sørensen & Holm, 2016). However, as long as they felt good and did not perceive themselves as overweight, they did not see any reasons for changing their diets. For this group, it seems likely that awareness of unhealthy diets may not be motivation enough for dietary change. Instead, there seems to be a need of increasing the knowledge of adverse health effects of unhealthy diets, and promoting health benefits of a healthy diet, regardless of present health and weight status.

Methodological considerations

A strength of the present study is the use of a nationwide random sample that enables generalizability of the results to the general adult population. A limitation is the response rate of 52 % as non-response bias may occur. The weighting of data cannot fully substitute for non-response. For example, studies have found that non-respondents are likely to have more unfavourable health and lifestyle characteristics (Christensen et al., 2015; Nyholm et al., 2008), and the findings of the present study should therefore be evaluated in this light.

Another strength is that estimated diet quality is based on data derived from seven-days pre-coded food diaries that are considered more accurate (Thompson & Subar, 2008) than food frequency questionnaires applied in other studies in this area (Brug et al., 1994; Dijkstra et al., 2014; Glanz et al., 1997; Jansink et al., 2012; Lechner et al., 1997). Furthermore, the categorizations of healthy and unhealthy diets were based on a modified version of a validated diet quality index (Knudsen et al., 2012). The diet index has proved to be a useful tool to describe the degree of compliance with FBDG. However, the diet index does not include absolute cut-off points defining healthy, intermediate and unhealthy foods – but a score that mirrors the compliance with five of the 10 food-based dietary guidelines that are quantifiable. Therefore, the categorizations of healthy and unhealthy diets were based on a relative measure. It is a strength that the identified proportions of optimistic and pessimistic assessors were found not to be sensitive to different cut-off points of the index score.

A limitation of the study is that the question used to measure self-assessed diet healthiness has not been validated in the context used in this study. However, in accordance with the intention of the question, our qualitative study (Sørensen & Holm, 2016) showed how interviewees did consider the healthiness of their diets subjectively when responding to the question. Furthermore, the overall categorisation of optimistic assessors and realistic assessors was replicated in the qualitative study. Another limitation of the question is the rather broad response category 'to some degree healthy enough'. The fact that half of the participants were categorised in this category (Table 1), substantiate a rather broad interpretation of what defines this category. Due to the risk of misclassifying individuals as optimistic and pessimistic assessors on the basis of this response category, it was decided to distinguish between highly and somewhat optimistic and pessimistic assessors. Furthermore, somewhat optimistic and pessimistic assessors were only included in the outcomes of the logistic regression models in sensitivity analyses.

Another potential limitation is that data on diet quality were collected in seven consecutive days, while data on self-assessed diet healthiness was a general assessment. In DANSDA 2011-2013, 70 % reported that their dietary intake in the registration period corresponded to their normal dietary habits (unpublished data from DANSDA). Thus, it cannot be excluded that some of the remaining 30 % were misclassified on this basis. However, participants' self-assessed disagreement between their dietary intake in the registration period and their normal dietary habits needs to be interpreted carefully. Deviations in the registration period, such as a birthday, prompt participants to report that their dietary intake do not correspond with their normal dietary habits even though a birthday party is not unusual in most people's lives. Furthermore, it would require significant dietary changes in the registration period to be classified in a different group of healthy, intermediate and unhealthy diets, and the issue is therefore considered to be of minor importance.

Conclusion

The present study found, that just above half of Danish adults with unhealthy diets assessed the healthiness of their own diets optimistically and thus may be unconscious about their higher risk for developing diet-related diseases compared with those with healthy diets. Two out of three of Danish adults with healthy diets assessed the healthiness pessimistically. Optimistic self-assessment was more likely among older adults and adults with favourable health characteristics, while pessimistic self-assessment was more likely among younger adults and adults with less favourable health characteristics. The findings emphasize a need for increasing the knowledge of adverse health effects of unhealthy diets, and promoting health benefits of a healthy diet, regardless of present health and weight status.

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Tables and figure

Table 1. Characteristics of the entire sample and of participants with unhealthy diets (diet index score <3.0) and healthy diets (diet index score ≥3.8)

	All N=3014	Unhealthy diets N=1005	Healthy diets N=1004
Socio-demography			
Gender (%, N)			
Men	48.6 (1464)	61.1 (614)	36.1 (362)
Women	51.4 (1550)	38.9 (391)	63.9 (642)
Age groups, years (%, N)			
18-24	11.4 (345)	15.8 (159)	9.2 (92)
25-44	30.4 (917)	35.2 (354)	25.7 (258)
45-64	40.7 (1228)	36.3 (365)	44.6 (448)
65-75	17.4 (524)	12.6 (127)	20.5 (206)
Age, years (mean, SD)	47.5 (16.0)	44.1 (16.2)	49.9 (15.6)
Educational level (%, N), N=2988			
Elementary school	14.2 (423)	19.6 (195)	9.9 (99)
Upper secondary school	7.9 (235)	9.4 (93)	7.1 (71)
Vocational training	38.6 (1154)	43.7 (434)	33.9 (338)
Short higher education	7.3 (219)	6.5 (65)	7.7 (77)
Medium higher education	20.1 (601)	13.8 (137)	25.7 (256)
Long higher education	11.9 (356)	6.9 (69)	15.7 (157)
Household income[a] DDK (%, N), N=2767			
<250.000	18.3 (507)	22.1 (202)	15.8 (145)
250.000-399.999	18.6 (516)	19.7 (180)	17.9 (164)
400.000-599.999	21.7 (601)	22.5 (206)	20.3 (186)
600.000-799.999	21.5 (595)	21.5 (197)	20.9 (191)
≥800.000	19.8 (548)	14.3 (131)	25.1 (230)
Health behaviour			
Diet index score (mean, SD)	3.3 (0.9)	2.4 (0.5)	4,3 (0.3)
Diet index, categorical (%, N), N=3014			
Low (unhealthy diets)	33.3 (1005)	100 (1005)	-
Intermediate (somewhat healthy diets)	33.3 (1005)	-	-
High (Healthy diets)	33.3 (1004)	-	100 (1004)
Self-assessed diet healthiness (%, N), N=3012			
Yes, to a high degree	25.2 (759)	15.0 (151)	35.7 (358)
Yes, to some degree	50.5 (1522)	44.5 (447)	51.9 (521)
No, only partly/not at all	24.3 (731)	40.4 (406)	12.4 (124)
Smoking behaviour (%, N), N=2993	20.8 (623)	34.2 (340)	11.5 (115)
Self-assessed PA level, leisure time (%, N), N=2992			
Vigorous	5.9 (177)	5.7 (57)	4.7 (47)
Moderate	32.3 (967)	27.1 (269)	35.9 (358)
Light	54.4 (1628)	53.9 (535)	55.4 (552)
Sedentary	7.4 (220)	13.3 (132)	4.0 (40)
Slimming diet (%, N), N=2993			
No	60.3 (1805)	63.3 (630)	57.7 (575)
Yes, now	6.0 (180)	4.4 (44)	6.9 (69)
Yes, within the last year	10.2 (304)	9.9 (99)	10.5 (105)
Yes, more than one year ago	23.5 (704)	22.3 (222)	24.8 (247)
Health			
Weight status (%, N), N=2719			
Normal weight (BMI <25)	43.4 (1181)	39.0 (355)	47.6 (429)
Overweight (BMI 25 - <30)	39.2 (1067)	39.0 (355)	38.6 (348)
Obese (BMI ≥30)	17.3 (471)	22.0 (200)	13.8 (124)
Abdominal weight status (%, N), N=2717			
Healthy[b]	41.8 (1137)	39.3 (353)	44.2 (398)
Abdominal overweight[c]	25.6 (696)	25.5 (229)	25.1 (226)
Abdominal obesity[d]	32.5 (884)	35.2 (316)	30.7 (277)
Elevated cholesterol, N=3001	12.7 (382)	9.6 (96)	15.4 (154)
Self-rated health (%, N), N=2994			
Excellent	24.1 (722)	21.4 (213)	27.5 (274)
Very good	37.6 (1127)	33.9 (337)	39.6 (395)
Good	30.0 (898)	33.5 (333)	27.2 (271)
Fair/poor	8.2 (247)	11.3 (112)	5.7 (57)

[a] 7.45 Danish kroner = 1 Euro
[b] Men: <94 cm; women: <80 cm
[c] Men: 94-101 cm; women: 80-87 cm

[d] Men: ≥102 cm; women: ≥88 cm

Table 2. Optimistic and realistic self-assessment among adults with unhealthy diets (diet index score <3.0) and pessimistic and realistic self-assessment among adults with healthy diets (diet index score ≥3.8). Percentages

	All	Men	Women	P-value*
Unhealthy diets (n=1005)				0.003
Highly optimistic assessors	13	15	9	
Somewhat optimistic assessors	42	41	44	
Realistic assessors	45	44	47	
Healthy diets (n=1004)				0.156
Highly pessimistic assessors	14	18	13	
Somewhat pessimistic assessors	51	48	52	
Realistic assessors	35	34	35	

* Gender differences. Tested using Chi-square (P<0.05)

Table 3. Odds Ratios (OR, 95% CI) for highly optimistic self-assessment of diet healthiness among participants with unhealthy diets[a] (diet index score <3.0) (outcome variable: highly optimistic vs realistic assessors) (N=497[b])

		OR	95% CI	P-value[c]
Age				**<0.001**
	18-24	**0.05**	**0.02-0.15**	**<0.001**
	25-44	**0.14**	**0.07-0.27**	**<0.001**
	45-64	1.00		
	65-75	**2.84**	**1.42-5.69**	**0.003**
Self-rated health				**0.004**
	Excellent	1.00		
	Very good	**0.36**	**0.19-0.69**	**0.002**
	Good	**0.34**	**0.17-0.65**	**0.001**
	Fair/poor	0.56	0.24-1.30	0.177
Weight status				**<0.001**
	Normal weight[d] (BMI <25)	1.00		
	Overweight (BMI 25 - <30)	**0.40**	**0.23-0.71**	**0.002**
	Obese (BMI ≥30)	**0.11**	**0.05-0.24**	**<0.001**
Physical activity, leisure time				**0.037**
	Vigorous	0.49	0.14-1.78	0.281
	Moderate	1.00		
	Light	**0.48**	**0.27-0.85**	**0.011**
	Sedentary	**0.36**	**0.15-0.83**	**0.017**

[a] Included factors: gender, age, educational level, household income, weight status, abdominal weight status, elevated cholesterol, self-rated health, slimming diet, self-assessed physical activity, smoking behaviour. Gender, age and education were kept in the model

[b] Optimistic assessors n=151, realistic assessors n=406, missing data n=60

[c] Tested using logistic regression (P<0.05)

[d] 1 % was underweight (BMI <18.5)

Table 4. Odds Ratios (OR, 95% CI) for highly pessimistic self-assessment of diet healthiness among participants with healthy diets[a] (diet index score ≥3.8) (outcome variable: highly pessimistic vs realistic assessors) (N=424[b])

		OR	95% CI	P-value[c]
Age				**<0.001**
	18-24	1.40	0.46-4.27	0.557
	25-44	**2.78**	**1.52-5.08**	**0.001**
	45-64	1.00		
	65-75	**0.48**	**0.24-0.95**	**0.035**
Self-rated health				**0.002**
	Excellent	1.00		
	Very good	1.89	0.99-3.60	0.054
	Good	**3.59**	**1.85-6.99**	**<0.001**
	Fair/poor	1.41	0.42-4.71	0.577
Weight status				**0.002**
	Normal weight[d] (BMI <25)	1.00		
	Overweight (BMI 25 - <30)	1.58	0.90-2.77	0.112
	Obese (BMI ≥30)	**3.75**	**1.82-7.73**	**<0.001**

[a] Included factors: gender, age, educational level, household income, weight status, abdominal weight status, elevated cholesterol, self-rated health, slimming diet, self-assessed physical activity, smoking behaviour. Gender, age and education were kept in the model

[b] Pessimistic assessors n=124, realistic assessors n=358, missing data n=58

[b] Tested using logistic regression (P<0.05)

[c] Less than 1 % were underweight (BMI <18.5)

		Self-assessed diet healthiness		
		To a high degree healthy	To some degree healthy	Partly/not at all healthy
Estimated diet quality	Unhealthy diets	Highly optimistic self-assessment 5 %	Somewhat optimistic self-assessment 17 %	Realistic self-assessment 18 %
	Somewhat healthy diets	Somewhat optimistic self-assessment 7 %	Realistic self-assessment 18 %	Somewhat pessimistic self-assessment 8 %
	Healthy diets	Realistic self-assessment 10 %	Somewhat pessimistic self-assessment 14 %	Highly pessimistic self-assessment 4 %

Figure 1. Proportions of optimistic, pessimistic and realistic assessors in the adult Danish population (N=3014)

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"I feel good and I am not overweight" – A qualitative study of considerations underlying lay people's self-assessments of unhealthy diets

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ABSTRACT

It has been suggested that optimistic self-assessments of unhealthy diets constitute a barrier to the promotion of healthier eating practices. In order to discuss possible reasons for such optimistic assessments, knowledge about the considerations underlying self-assessments of unhealthy diets is needed. The aim of this qualitative study is to explore this issue by comparing considerations underlying the assessments of people who overestimate the healthiness of their unhealthy diets with those of people who express more realistic assessments. Interviewees were recruited among those respondents to the Danish National Survey of Diet and Physical Activity 2011–2013, who had been accorded a low diet index score. A thematic analysis of qualitative interviews is undertaken (N = 16). When interviewees are asked to assess the healthiness of their diets, they draw upon their nutritional knowledge and their perceptions of healthy eating practices. However, these considerations tend to be overruled by more decisive criteria. Thus, diets are assessed as being not exactly healthy, but nevertheless healthy enough – so long as interviewees feel good. Moreover, a personal history of weight status and weight concerns emerge as decisive criteria in self-assessments. Those who experience problems in these areas tend to be realistic about the unhealthy character of their diets, while optimistic assessments appear to be linked to tendencies to perceive oneself as not being overweight, not having experienced weight gain or loss, or not being concerned about weight. This study concludes that decisive criteria in lay people's self-assessments of unhealthy diets – with regard to feeling and looking good – differ markedly from the criteria employed in food-based dietary guidelines. These broader criteria of assessment should be recognized by professionals engaged in planning health promotion strategies with reference to dietary health.

1. Introduction

People tend to assess the healthiness of their diets more optimistically than when these diets are evaluated on the basis of scientific standards, as outlined in official food-based dietary guidelines (FBDG) (Brug, van Assema, Kok, Lenderink, & Glanz, 1994; Dijkstra, Neter, Brouwer, Huisman, & Visser, 2014; Glanz, Brug, & van Assema, 1997; Jansink et al., 2012; Lechner, Brug, & De Vries, 1997; Variyam, Shim, & Blaylock, 2001). This has been found to hold for a significant percentage of different populations in relation to fat, fruits and vegetables and overall diet quality. Those who overestimate the healthiness of their diet – as evaluated by scientific standards – are also found to be less likely to intend to change their diet, as compared to those who express more realistic assessments of the healthiness of their diet (Brug et al., 1994; Jansink et al., 2012; Variyam et al., 2001). Accordingly, it has been suggested that overestimation of the healthiness of one's diet constitutes a barrier to the promotion of healthy eating practices. From a public health perspective, this is of special concern in regard to people who, from a nutritional point of view, eat unhealthily.

In order to promote healthier diets in the Danish population, several of initiatives have been implemented, in recent years for example "The Keyhole label", "The Wholegrain Partnership" and the "The Danish Meal Partnership" (Danish Veterinary and Food Administration, 2016). However, compliance with Danish FBDG

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remains low. A recent national representative study shows that 97% of Danish adults do not comply with the recommendation for saturated fat (<10 E%), that 83% do not comply with the recommendation for fruit and vegetables (600 gr/10 MJ/day), and that 33% have a diet containing more than the recommended maximum intake of sugar (<10 E%) (Pedersen et al., 2015).

Cross-sectional studies about overestimation of dietary healthiness suggest that the complexity entailed in assessing dietary intake is probably one reason why people overestimate the healthiness of their own diets (Brug et al., 1994; Dijkstra et al., 2014; Variyam et al., 2001), and feedback on people's intake has been suggested therefore as a strategy for making people aware of their unhealthy diets (Brug et al., 1994; Glanz et al., 1997; Variyam et al. 2001). However, to the authors' knowledge, no in-depth exploration of what this 'overestimation' or 'optimistic assessment' entails has yet been undertaken. In-depth explorations of lay people's interpretation of healthy eating have identified meanings related to healthy eating habits that nutrition professionals do not usually take into consideration (Bisogni, Jastran, Seligson, & Thompson, 2012). In order to discuss possible reasons for people being more optimistic about the healthiness of their diets than when evaluated on the basis of scientific standards, knowledge about the considerations underlying self-assessments of unhealthy diets is needed.

The present study was designed in light of the results of a recent study (Sørensen et al., unpublished), which found that 55% of Danish adults, whose diets were unhealthy, consider their dietary habits to be healthy enough. This prior study was based on data derived from The Danish National Survey of Diet and Physical Activity 20011–2013 (DANSDA). Diet quality had been evaluated on the basis of seven-day food records, and the diet of each individual evaluated by means of a diet index score based on five food and nutrient guidelines drawn from the Danish FBDG 2013 (Danish Veterinary and Food Administration, 2013). By means of qualitative interviews, the intention of the present study is to explore what might be behind such optimistic self-assessments, and interviewees are recruited among respondents to DANSDA.

In accordance with previous studies concerning the tendency to overestimate dietary healthiness, 'optimistic self-assessment' is identified here by comparing each respondent's own assessment of the healthiness of his or her diet with an assessment of this diet based on scientific standards outlined in FBDG. Respondents' implicit definitions of healthy eating habits must be assumed to underlie their responses, and thus also underlie their subsequent classification as being either optimistic or realistic assessors. Studies have shown that lay peoples' perceptions of healthy eating practices are in many ways in-line with FBDG (Bisogni et al., 2012; Falk, Sobal, Bisogni, Connors, & Devine, 2001; Holm, 2012; Margets, Martinez, Saba, Holm, & Kearney, 1997; Paquette, 2005; Povey, Conner, Sparks, James, & Shepherd, 1998). However, lay people tend to include additional elements in their understanding of healthy eating practices, such as whether or not food is organic or unprocessed, the regularity of meals and psychosocial well-being – none of which are included in FBDG. This more broad perception of healthy eating may underlie the tendency to overestimate the healthiness of one's own diet. The recent quantitative study referred to above (Sørensen et al., unpublished) also found that individuals who have excellent self-rated health, a healthy weight and are physically active in their leisure time were more likely to overestimate the healthiness of their diets. One intention of the present study is to seek to clarify what might be behind this association. By exploring the considerations underlying self-assessments among people who overestimate the healthiness of their diets, as compared with people who are realistic about the healthiness of their diets, we hope to uncover differences between these two groups that would help to elucidate possible reasons for optimistic assessments.

The aim of this qualitative study is thus to explore the considerations underlying lay people's self-assessments of unhealthy diets and to compare the considerations of those who optimistically overestimate the healthiness of their diet with those who have more realistic assessments. In each case, considerations about healthy eating practices and personal health are explored in order to elucidate possible differences between these two groups.

2. Material and methods

In order to obtain an in-depth understanding of lay perspectives, this study was based on qualitative, individual interviews. Sixteen interviews were conducted. As assessed according to FBDG, all interviewees had unhealthy diets – eight of whom considered their diets to be healthy enough ('optimistic assessors') and eight of whom did not consider their diets to be healthy enough ('realistic assessors').

2.1. Interviewees

Interviewees in the present study were recruited among respondents to the Danish National Survey of Diet and Physical Activity 2011–13 (DANSDA). DANSDA is a nationwide, cross-sectional survey in which data regarding diet, physical activity, anthropometrics, health-related lifestyle and socio-demographic factors were collected from a representative sample of the Danish population (N = 3946), from Spring 2011 to Summer 2013 (Pedersen et al., 2015), the sample having been drawn from the Danish Civil Registration System. Given limited resources, 16 interviews were considered to be a satisfactory number. When 14 interviews were completed, it had become clear that no new substantive information was being acquired. However, all 16 interviews were conducted.

Interviewees were chosen in accordance with definitions of optimistic assessors and realistic assessors in the prior quantitative study (Sørensen et al., unpublished). As such, they were chosen on the basis of the DANSDA evaluation of the quality of their diet and their response to the survey question "Do you consider your dietary habits to be healthy enough?" Diet quality had been evaluated on the basis of seven-day, pre-coded food diaries, and the diet of each respondent evaluated by means of a diet index score based on five food and nutrient guidelines drawn from the Danish FBDG 2013: energy from saturated fat (max 10%), energy from added sugar (max 10%), intake of fruits and vegetables (min 600 g/10 MJ/day), intake of fish (min 350 g/10 MJ/week) and intake of wholegrain (min 75 g/10 MJ/day). The diet index was a slightly modified version of a validated diet index based on the Danish FBDG 2005 (Knudsen et al., 2012). For each respondent in the DANSDA survey, a score between 0 and 1 had been calculated with reference to level of compliance with each of the five guidelines included in the index. The total score was calculated as the sum of the five scores, ranging from 0 to 5, a score of 0 being furthest from compliance with the dietary guidelines and 5 indicating compliance with all five guidelines. Since less than 1% of respondents complied with all five guidelines, this was not a relevant cut-off point for distinguishing healthy and unhealthy diets. Thus, a relative measure of unhealthy diets was chosen, and individuals with a diet index score in the lowest third of the total diet index were defined as having unhealthy diets. This corresponds to a diet index score between 0 and 3.01. The 16 interviewees in the present study had obtained a score in the lowest third of the total index. Optimistic assessors had a mean score of 2.3 and the realistic assessors a score of 2.5.

The question "Do you consider your dietary habits to be healthy enough?" had been asked as an open-ended question in a

structured questionnaire administered by personal interview, and was one of a total of 60 questions concerning respondents' health-related lifestyle and socio-economic background. It was the interviewer's task in the DANSDA survey to categorize responses to this question under one of four pre-defined response categories, which were not shown to respondents. These were: "Yes, to a high degree", "Yes, to some degree", "No, only partly" or "No, not at all". Responses among Danish adults were 22%, 49%, 24%, and 5%, respectively (Sørensen et al., unpublished). According to the DANSDA survey, eight of the 16 interviewees in the present study had assessed their dietary habits as being healthy enough (seven "to a high degree" and one "to some degree") and were categorized as being optimistic assessors. Eight had assessed their dietary habits as not being healthy enough (eight "only partly") and were categorized as realistic assessors.

Dietary intake and perceptions of healthy eating vary by gender, age and educational level (Christensen, Ekholm, Davidsen, & Juel, 2012; Elmadfa et al., 2009; Groth et al., 2014; Margets et al., 1997; Pedersen et al., 2015). In order to identify themes and patterns across these variations, interviewees were purposively selected with a view to obtaining a differentiated sample in regard to each of these dimensions. Weight status was not included as a recruitment criterion in the present study. It later transpired from the analysis, however, that this was relevant, and therefore BMI data, along with the interviewees' gender, age and educational level, are included in Table 1. All 16 interviewees lived within the area of greater Copenhagen.

Interviewees were contacted by telephone. They were reminded about their earlier participation in the DANSDA survey and about then having given consent to being contacted in case of further studies. They were informed about the content of the interview, their anonymity and their right to withdraw from the study at any time. All who were contacted were willing to participate. One subsequently cancelled the interview due to lack of time, and a replacement interviewee was recruited. All received confirmation of their interview by e-mail, including a repetition of the interview content and assurance of anonymity as well as their right to withdraw from the study.

2.2. Interview guide and data collection

A semi-structured interview guide was developed for the purpose of exploring the considerations underlying self-assessments of unhealthy diets. The interviews were conducted by the first author in February and March 2015, a period from two to four years having thus expired since these interviewees had participated in the DANSDA 2011–13 survey. Following the introductory remarks, interviewees were therefore asked about changes in their lives with regard to education, work, family and dietary habits in the period between their participation in DANSDA survey and the present interview. While making the introductory remarks, the point was emphasized that the interviewer was a sociologist with no expert knowledge about nutrition and that the focus of the interview was upon the perspectives of the interviewee. In order to obtain initial descriptions of the ways in which food and meals are characterized, interviewees were then asked about their meals the previous day. Next, the interviewer asked the same question as had been posed in the DANSDA survey and that was used in the present study to categorize interviewees as being either optimistic or realistic assessors: *Do you consider your dietary habits to be healthy enough?* We were particularly interested in the thoughts and reflections of each interviewee on this issue, and follow-up questions were posed in order to explore the considerations behind initial responses. As part of this process, interviewees were shown and asked to place themselves under one of the pre-defined response categories that had been used in the DANSDA survey. Additional follow-up questions were also posed on this point. Since dietary healthiness was a key concept, we asked questions regarding the perception of health and healthy eating and the personal importance of these for the interviewee. In order to further clarify the interviewees' standards for what a 'healthy *enough*' diet might entail and to clarify the gap between interviewees' perceptions of healthy eating and the scientific standards by which they have been classified, we asked about sources of their knowledge, followed by questions about their knowledge of and about Danish FBDG, and their potential use of these guidelines. An overview of themes in the interview guide is presented in Box 1.

Questions about the interviewees' behaviour and health were

Box 1
Themes in the interview guide

Potential changes (education, work, family and dietary habits)
Yesterday's meal
Do you consider your dietary habits to be healthy enough?
Perceptions of healthy/unhealthy eating
Importance of healthy eating
Perception of health, description of a healthy/unhealthy person
Assessment of own health and health lifestyle
Guidelines and other sources of knowledge about healthy eating
Knowledge about Danish FBDG

Table 1
Characteristics of interviewees (adults with unhealthy dietary habits): Gender, age, educational level and weight status. Names are pseudonyms.

	Age (years)	Optimistic assessors				Realistic assessors			
		Basic/Vocational education	Short higher education	Medium higher education	Long higher education	Basic/Vocational education	Short higher education	Medium higher education	Long higher education
Women	25–34		Trine[a]			Katrine[a]			
	35–44								
	45–54			Lene[a]			Dorte[b]		Pernille[a]
	55–64		Hannah[a]		Karen[a]			Lisbeth[c]	
Men	25–34								Jakob[a]
	35–44	Samir[a]			Lars[a]	Marko[b]			
	45–54				Mikael[b]	Karsten[b]		Niels[b]	
	55–64	John[b]							

[a] Normal weight (BMI<25).
[b] Overweight (BMI 25–29.9).
[c] Obese (BMI≥30).

asked in an open manner, leaving it to each of the interviewees to choose what they wanted to talk about. Questions about body weight in general and interviewees' personal body weight were not included in the interview guide and only became part of the interview when interviewees raised these topics themselves.

The interview guide was tested in a pilot interview and minor adjustments were made. Most interviews took place in the home of the interviewee. However, one interview took place at the work place of the interviewee and one took place at the workplace of the interviewer. Typically, the interviews lasted between 40 and 60 min, and on average 50 min. Interviews were recorded on a digital voice recorder and transcribed to word level accuracy. Transcriptions were carefully checked by the first author.

2.3. Analysis

A thematic analysis of the interviews was undertaken that was primarily explorative, but also included predefined themes. The analysis proceeded in a dynamic fashion with phases of interpreting data, identifying themes and coding in multiple rounds. The interviewer (1) noted reflections and impressions of each interview following its completion and summarized pronounced themes and issues, (2) read each transcribed interview, noting content related to predefined themes and identifying new themes, (3) summarized each interview and noted how it contributed to elucidating the research objective, (4) summarized themes and identified recurring themes across interviews, (5) discussed themes with co-author and determined salient themes that could help to clarify our objective further, listing corresponding codes, (6) read and coded each interview in accordance with the coding list. The next step in the analytic process was to compare themes across the 'optimistic assessors' and 'realistic assessors'. This analytic process was inspired by Miles and Huberman (Miles & Huberman, 1994) and Kvale and Brinkman (Kvale & Brinkmann, 2009), and the qualitative software package NVivo 10 was used to code and analyse data.

3. Results

3.1. Self-assessments of diet healthiness

Most interviewees reported that no substantial changes had taken place in their dietary habits since they had participated in the DANSDA survey. Three of the four who did report changes indicated that their diet had become less healthy and that they had gained weight, while one reported that he had begun to eat more healthily and had lost some weight. All four belonged to the group that had been classified as comprising 'realistic assessors'.

When interviewees in the present study answered the question as had been posed in the DANSDA survey: "Do you consider your dietary habits to be healthy enough?" most of them did not answer immediately, but paused before saying, "I think…", "well, maybe…", "that depends on…", or "I'm not sure…". The pattern identified in the DANSDA survey, whereby optimistic assessors presented more positive assessments of the healthiness of their diets than did realistic assessors, was replicated. However, some of the realistic assessors were less negative about the healthiness of their diets than indicated by the DANSDA results. For both groups, it was found that most assessments developed in the course of the interview and proved to be more complex than indicated by the categorisations applied in the DANSDA survey.

Later in the course of the interview, interviewees were shown the pre-defined response categories used in the DANSDA survey and asked to place themselves in one of the four response categories. Many placed themselves in between categories or in a category that differed from the categorisation of their earlier responses to the survey questionnaire. Seeing these response categories seemed to incline interviewees to select categories in the middle range. While some few explained that their diets had changed somewhat in the meanwhile, others explained that they did not want to place themselves in an extreme category, because they did not see themselves as being among the healthiest or the unhealthiest. Despite this tendency to choose middle range categories, the optimistic assessors were still generally more optimistic about the healthiness of their diets than were the realistic assessors. Nevertheless, the basis on which optimistic assessors had been distinguished from realistic assessors became less clear-cut when detailed responses were elicited by means of qualitative interviews.

3.2. Decisive criteria in self-assessments

It emerged at an early point in the data collection that bodily aspects seem to play an important role in self-assessments of diets. These aspects revolve around three themes: overall feelings of wellbeing, bodily feelings about which foods are healthy and unhealthy, and the interviewee's weight status or weight concerns. The first of these is illustrated in this excerpt:

> "I'm well, and I don't feel tired or out of sorts or anything like that. I can keep going at work for 9 hours without being tired, without thinking, you know, *Holy Moly!* So, one way or another I'd say one's body is saying: it's okay. It's okay, I'm fine. To my way of thinking, that's what is most important – that one has the energy to do the things one wants to do." (Katrine, realistic assessor)

Throughout the interview, Katrine does not hesitate to describe her dietary habits as not being healthy. She explains that she eats quite unhealthily at times: "So, I know well there are times when – if my doctor showed up and saw what I was eating – my doctor would say to me: are you out of your mind? You're on the road to a heart attack and all kinds of other things!" She characterizes her dietary habits during these periods as being "only partly healthy enough". At other times, she eats more healthily and characterizes her eating habits in these periods as being "to some degree healthy enough" – even though she is well aware that they would not be considered healthy if, as she points out, "you were to ask a dietitian". However, overall and without thinking about categories, she considers her dietary habits to be "okay", because she feels good. Thus, dietary habits in this case, as in other cases, are self-assessed as being not exactly healthy, but nonetheless healthy enough. Two interviewees (John, optimistic assessor; Lisbeth, realistic assessor) have elevated cholesterol and hypertension, but they do not experience symptoms that make them feel bad in any way, and therefore do not see any reason why they should eat more healthily. For many interviewees, it seems that feeling good functions as the criterion whereby they judge whether or not they are eating healthily enough.

Several interviewees express the view that their bodies tell them what, for them personally, is healthy or not. This is sometimes expressed as a general feeling as in the citation above, but others also talk about how they feel that their body is in need of something specific:

> "I've noticed sometimes that it's related to one's body too… sometimes I feel, like I have this crazy need for one thing or another. I can feel that. Then I have to have some vegetables – broccoli or some other thing. I just have to have it. It's as though one has a deficit of something or other. That's the way I am sometimes.

Okay – it sounds almost as though it's a physical feeling?

Oh, it is! The way it is… I don't know what it is exactly, but out of the blue I just get the feeling that there's a need for one thing or another. I've had that experience many times." (Karen, optimistic assessor)

Throughout the interview, Karen expresses a general satisfaction with the healthiness of her dietary habits. She no longer tries to comply with dietary recommendations because, as she says, "then they change again". Instead she eats what she likes and what she feels is good. Thus, her body – rather than external dietary guidelines – provides her with a decisive guideline for healthy eating. Referring to bodily feelings about what is healthy or not occurs more often among the optimistic assessors than the realistic assessors, and is typically mentioned as a justification for eating unhealthy foods. If the intake of sugar, for example, does not make the interviewee feel bad, then it is not considered unhealthy to eat.

Weight status and weight concerns are dominant topics throughout the interviews. Moreover, this is the point on which we do find some clear differences between the two groups of optimistic and realistic assessors. All of the realistic assessors are to some extent conscious of their weight status, either because they perceive themselves as being overweight at present, because of earlier experiences with gaining or losing weight, or because of concerns about gaining weight. Most of the realistic assessors talk about one or more periods in their lives in which they had focused on what they ate in order to lose weight, and several of them define healthy and unhealthy foods on the basis of foods they experience as having a slimming or fattening effect. One of these offers the following concise answer to the question what healthy food is for him: "Yes, it's something surely that doesn't make you too fat" (Niels, realistic assessor). In contrast, although optimistic assessors refer to their weight, none perceive themselves as being overweight – regardless of their actual weight. Nor have they, with one exception, ever had a focus on losing weight, and are generally not concerned about their weight. In general, many of the interviewees talk about calories when talking about healthy and unhealthy foods.

The interviewees' present weight status emerges as an argument for why eating habits are considered to be healthy enough. Among the realistic assessors, however, weight status constitutes an argument for why they are not eating healthily enough. The former viewpoint is expressed by one of the optimistic assessors in the following way:

"So long as I'm not up to 120 kg – if I was, then of course I'd probably have changed my eating habits. But I'm around the 100 mark, and I'm fine with that… Because I can do my job, and if some take the elevator up to the seventh floor, well then – if there isn't room – I can take the stairs. It doesn't bother me at all… And if we're going down, well then I can run down too without any bother at all. So long as I can do that, then I don't think I'm unhealthy or anything like that." (John, optimistic assessor)

Defined on the basis of body mass index, John would be characterized as being overweight. However, for him personally 100 kg is not too much, because he is able to do what is important for him.

This citation also serves as an illustration of a common pattern in these interviews: the crucial role that perceived weight status plays in the perception of a need to change dietary habits. Thus, unhealthy dietary habits give rise to a desire to change these habits only when they are related to a desire to lose weight. Several interviewees emphasize that they would never think about eating more healthily if they were not overweight or if they were unlikely to gain weight.

3.3. Other criteria employed in self-assessments

When responding to the question "Do you consider your dietary habits to be healthy enough?" interviewees typically refer to specific foods they eat – usually both healthy and unhealthy foods and typically explicitly described as such. For example, one interviewee says, "I can get up in the morning and if there's a bar of Marabou-chocolate lying around, for instance, I eat that. If there are potato crisps, I can also eat potato crisps in the morning. Well, I have to say, that sounds like bad eating habits. Ha-ha, hardly healthy eating habits, are they?" (Pernille, realistic assessor). In general, fruits, vegetables and fish are highlighted as healthy foods while fat and sugar rich foods such as cake, candy and fast food are highlighted as being unhealthy. As such, it seems that the interviewees' considerations about which foods are healthy or unhealthy in many ways accord with FBDG. However, they also include additional elements, such as whether foods are organic, which do not accord with FBDG.

Some interviewees also explicitly refer to different guidelines for healthy eating while making their assessments. Only a few of the interviewees know about the Danish FBDG. Instead they refer to other guidelines such as "the recommended amount", "the paleo diet" or "the food pyramid". Doing so, assessments of their own diet tends to be less positive. For instance, one interviewee comments that her dietary habits are "only fairly healthy, because I don't think I actually get up to the recommended level of 6 vegetables per day. No, I don't think that" (Karen, optimistic assessor). Some interviewees also refer to different practices related to eating that they consider to be either healthy or unhealthy, for example eating regular meals or eating candy only during weekends. These practices also constitute part of the interviewees' arguments as to why they consider their dietary habits to be healthy enough or not healthy enough.

We did not find any substantial difference between the optimistic and realistic assessors with respect to which specific foods, eating practices or guidelines are mentioned. Most references to these issues accord with FBDG, but also include a variety of additional aspects that reflect individual beliefs about healthy eating. If nutritional knowledge and considerations about healthy eating practices among optimistic assessors differ to a greater extent from FBDG than knowledge and considerations among realistic assessors, these factors may be thought to underlie the tendency to overestimate the healthiness of one's own diet. However, our findings do not support this view. It is noteworthy, however, that realistic assessors do tend to include more references to these issues, and these considerations in turn are used to substantiate the assessments of their diets as being less healthy.

Comparisons with earlier dietary habits and descriptions of other health related behaviours such as smoking and physical activity also play a part in some interviewees' assessments. Thus, the healthiness of a current diet is sometimes assessed relative to earlier healthier or unhealthier dietary habits, and less healthy eating habits are sometimes seen as being compensated for by being for example physically active. These themes are not dominant ones, but they highlight the range of considerations that underlie interviewees' self-assessments.

The distinction between 'decisive criteria' and 'other criteria' is based on several observations. In some cases, the interviewees explicitly express the view that a certain consideration is decisive for them. In their immediate response to the question "Do you consider your dietary habits to be healthy enough?" they state that they eat both healthy and unhealthy foods. However their response

quickly moves on to the consideration of bodily aspects as overruling their initial response – exemplified above by Katrine. In other cases, interviewees refer to bodily aspects in their assessment when the interviewer prompts for thoughts and considerations underlying their initial responses. Furthermore, specifically related to personal history of body weight and weight concerns, these themes in several interviews remain dominant throughout most of the interview, and considerations about healthiness are always related in one or another way to body weight.

4. Discussion

In this paper we have explored the considerations underlying self-assessments of dietary habits. All interviewees had unhealthy diets, as defined in accordance with FBDG. Half of these had assessed their diets as being healthy enough and the other half as not being healthy enough in their responses to a survey questionnaire completed prior to their participation in the present study. By comparing self-assessments among those who were respectively optimistic and realistic assessors, we hoped to clarify possible reasons for the optimistic assessment of unhealthy diets.

In the course of assessing their diets, the interviewees discuss foods and eating practices and sometimes refer to different guidelines. However, the more decisive considerations underlying their self-assessments are found to revolve around bodily sensations and body weight history: feelings of wellbeing, bodily feelings with respect to foods, personal history of body weight and weight concerns. A marked difference between the self-assessments of optimistic and realistic assessors is found in regard to the perception of personal weight status and the presence of weight concerns.

The classification of 'optimistic assessors' and 'realistic assessors' is based on the response to the survey question, "Do you consider your dietary habits to be healthy enough?", as compared with a dietary assessment based on the scientific standards of FBDG. In the present study, when interviewees assess the healthiness of their diets, they draw upon their nutritional knowledge and their perceptions of healthy eating practices. Our study shows that some of these considerations include perceptions of healthy eating that are in line with FBDG on several points, but also include additional aspects – such as whether or not food is organic, meals are eaten at regular times or snacks restricted to particular times. These findings accord with other studies of lay people's interpretations of healthy eating (Bisogni et al., 2012; Falk et al., 2001; Holm, 2012; Margets et al., 1997; Paquette, 2005; Povey et al., 1998). However, we did not find any substantial differences between perceptions of healthy eating practices among optimistic assessors as compared with realistic assessors, and our findings do not support the view that optimistic assessments are a consequence of perceiving healthy eating habits in ways that differ distinctly from official recommendations, as represented by FBDG.

Instead, our study suggests that perceived weight status and weight concerns are of decisive importance in self-assessments of the healthiness of unhealthy diets. Thus, overweight seems to function as a sign of an unhealthy diet, which cannot be ignored insofar as it is visible to self and others, and which therefore serves as a guiding principle when people assess their diets as not being healthy enough. It would seem that weight concerns and/or experiences with losing and gaining weight are factors that lead people to assess the healthiness of their unhealthy diets in a manner that accords with the science-based standards of FBDG. In contrast, if people do not perceive themselves as being overweight or do not have experiences of weight loss or weight gain, these factors appear to encourage them to make more optimistic assessments of the healthiness of their unhealthy diets than would be warranted by FBDG. In the prior quantitative study (Sørensen et al., unpublished) we found that individuals who had a healthy weight were more likely to overestimate the healthiness of their unhealthy diets. The findings of the present study suggest that such optimistic self-assessments seem to be a consequence of not perceiving oneself as being overweight, not having the experience of losing or gaining weight or not being concerned about personal weight.

A review (Bisogni et al., 2012) of 195 qualitative studies of lay people's interpretations of healthy eating referred to only seven studies in which weight was associated with healthy eating (Backett-Milburn, Wills, Gregory, & Lawton, 2006; Blake & Bisogni, 2003; Dixey, Sahota, Atwal, & Turner, 2001; Dye & Cason, 2005; Falk et al., 2001; Gustafsson & Sidenvall, 2002; Watt & Sheiham, 1997). Falk et al. (2001) found that weight control was the most important theme to emerge in definitions of healthy eating among less than one in five interviewees. In our study, weight was found to have a much more dominating role than indicated by these previous studies. The focus of our study was not upon definitions of healthy eating as such, but rather upon considerations underlying the self-assessment of personal diets among those who have unhealthy eating habits. Thus, our study suggests that there might be an important difference between the criteria widely employed in lay perceptions or implicit definitions of healthy eating habits and the criteria that appear to be of decisive importance in assessing the healthiness of one's own diet, particularly among the members of this population group. Another reason why body weight emerges as a central topic throughout the interviews in the present study might be due to the focus on obesity and the need for healthy eating habits in public media, not least in Denmark. One of the main arguments behind the first and overall recommendation in the Danish FBDG "eat a varied diet, not too much and be physically active" is to maintain a healthy weight (Danish Veterinary and Food Administration, 2013). Furthermore, in the Danish National Action Plan with reference to obesity, the promotion of healthier diets is the focal point of the proposals for action (National Board of Health, 2003).

Wellbeing is also found to be an important consideration underlying assessments to the effect that eating habits are healthy enough. Feelings of wellbeing are only referred to in positive terms, and their importance as a criterion of assessment for some people is illustrated when this consideration overrides other considerations about the fact that foods eaten or other aspects of eating practices are not healthy. Thus, our findings suggest that people can be well aware that they do not eat healthily, but are still likely to assess their diet as being healthy enough – as long as they feel good.

It is found that people tend to emphasize their healthiness rather than their lack of good health (Blaxter, 1990), and in an interview setting it is certainly possible that interviewees will tend to present their feelings of wellbeing in a more positive light than warranted and to avoid raising topics about negative feeling states (Loosveldt, 2008). In contrast, the presence of overweight and especially obesity are difficult to hide in an interview setting, and appears to be accepted by many interviewees in the present study as a visible sign of unhealthy eating habits. This might be one reason why overweight – and not negative feelings or elevated cholesterol and hypertension – was emphasised as a sign of unhealthy diets.

The bodily aspects identified as decisive criteria underlying interviewees' self-assessments – overall feelings of wellbeing, bodily feelings about which foods are healthy and unhealthy, and the interviewee's weight status or weight concerns – accords with embodied dimensions of health identified by Watson (2000). These dimensions cover bodily appearance (normative), the ability to manage demands in everyday life (pragmatic), experiencing wellbeing (experiential), and the biological body where health can only be conceived medically, for example through a blood test (Visceral)

(Holm & Smith, 2011; Watson, 2000). All four dimensions are present in our study. However, the visceral dimension is the least apparent in the considerations underlying interviewees' self-assessments. For example, wellbeing overrides medical conditions such as hypertension and elevated cholesterol. Further, while BMI is hardly mentioned as an indicator for overweight in the present study, the indicator of "weighing too much" typically relates to appearance – looking fat in a bikini, having a visible belly or – as exemplified above with John – the capability to manage important tasks in everyday life. The importance of appearance – rather than health – as a key motivation behind dieting has also been pointed out in previous studies (Clarke, 2002; Gough, Seymour-Smith, & Matthews, 2016). In contrast, the definitions of healthy eating in FBDG are based on comprehensive reviews of scientific literature, documenting associations between diet and measurable health effects such as the occurrence of specific illnesses (National Board of Health, 2003; Nordic Council of Ministers, 2014; Tetens et al., 2013; World Cancer Research Fund/American Institute for Cancer Research, 2007). Our study supports earlier findings that lay people have more subjective and broader conceptions of health (Blaxter, 1990) and more holistic views about healthy eating habits (Bisogni et al., 2012). Rather than objective measures of health and weight status, feelings of wellbeing and perceived weight status seem to be vital considerations underlying lay people's assessments of the healthiness of their diets. In seeking to promote FBDG, it would seem to be important that nutritional professionals should acknowledge these differences between lay and science-based dietary assessments.

As noted earlier, overestimation of dietary healthiness has been identified as a barrier to the promotion of healthier eating practices. It has been suggested that this tendency to overestimate is a consequence of the complexity of dietary health assessment, and feedback on people's dietary intake has been suggested as a strategy that could enable them to become aware of unhealthy diets. The findings of the present study indicate a need to modify this suggestion. Our findings indicate that weight is an important guiding principle in lay assessments of the healthiness of diets. Moreover, our study suggests that weight and weight concerns are decisive factors in regard to whether or not people who have an unhealthy diet feel a need to even consider whether they eat healthily enough. If people do not feel that need, it would seem most unlikely that they would reach the point of being motivated to tackle the complexity of dietary health assessment.

The results of this study highlight the fact that bodyweight seems to play a dominant part in the lay understanding of diet and health, at least among those who have unhealthy diets, and that considerations about healthy eating habits as such seem to be of secondary importance. In planning health promotion strategies with reference to dietary health, there seems to be a need to draw attention to the fact that weight status is not always an indicator of dietary health and that unhealthy eating habits are a risk factor, regardless of weight status. Our findings suggest that these messages should be directly addressed in health promotion initiatives. Additionally, it would seem relevant to clarify the fact that unhealthy diets have long term effects on health status, regardless of current feelings of wellbeing. Attention to these issues might encourage people to reconsider their assessments of their own diets, even when they feel good, are not overweight or concerned about their weight.

4.1. Methodological considerations

Our study exemplifies the way in which qualitative methods can uncover relatively complex patterns of reflection among sub-groups of interviewees, while classifications based on quantitative data had indicated a more clear-cut distinction between sub-groups who assess their diets as being either healthy or unhealthy. This tendency is characteristic of qualitative as compared to quantitative methods and is thus hardly surprising. What is more noteworthy is the tendency of interviewees to select middle range categories in the present study as compared to the categorisation of their responses in the DANSDA survey. Both studies employed the method of personal, face-to-face interview. However, in the DANSDA survey, the interviewer categorised responses according to predefined categories that were not shown to respondents, whereas in the present study interviewees were shown these response categories and asked to choose the category that best described themselves. As mentioned by some interviewees, one reason for choosing a middle range category was that they did not see themselves or want to be seen as belonging to an extreme group, that is, among the healthiest or the unhealthiest. Since the interviews in the present study were conducted between two to four years following the interviews in the DANSDA survey, changes in dietary habits might also be thought to explain the several instances of disparity between the selected response categories at different points in time. However, as we have seen, most interviewees in the present study did not report any substantial changes in their dietary habits as having taken place in the period between their participation in the DANSDA survey and the present study. The ones who did report changes were realistic assessors, who typically explained how their diets had become less healthy. The one who explained how his diet had become healthier was also less negative in his self-assessment at the later point in time. These reported changes did not therefore undermine the classification of interviewees as belonging to optimistic or realistic sub-groups. It might be expected that other factors such as changes in educational level, nutritional knowledge or body weight would account for some disparities in regard to self-assessments at different points in time. However, our data did not indicate that changes in educational level or nutritional knowledge had occurred among these interviewees during this period of time. These factors do not therefore seem to account for disparities between response categories at different points in time. Whereas notable changes in body weight had occurred among the four interviewees who had changed their dietary habits. Since these changes followed the same pattern as their reported dietary changes, they did not impinge upon their classification as being realistic assessors. Overall, despite the tendency to select middle range categories to a greater extent in the present study, those classified on the basis of quantitative data as 'optimistic assessors' nevertheless selected "Yes" response categories to a greater extent in the present study, while those classified as 'realistic assessors' selected "No" categories to a greater extent. The classification of sub-groups on the basis of quantitative data thus proved useful in the present study insofar as it mediated an understanding of some marked points of difference between these sub-groups as well as several points of similarity.

The recruitment of interviewees among respondents to the DANSDA survey was a strong feature of our research design, since it made it possible to explore self-assessments of diets among people whose dietary habits were known beforehand. Furthermore, the targeted recruitment was of vital importance to obtaining a sample with a good distribution with reference to gender, age and educational level. The earlier quantitative study (Sørensen et al., unpublished) had shown that individuals who have excellent self-rated health, healthy weight and a physically active leisure time were more likely to overestimate the healthiness of their diets. The present study has highlighted the role of feelings of wellbeing and weight status in optimistic assessments of the healthiness of one's own diet. Given limited resources, however, it was not possible to

select a sample that might facilitate a systematic exploration of the meanings underlying these specific associations in any more detail.

Since weight status emerged from our initial analysis as a decisive criterion in self-assessments of dietary health, we became aware of the differentiation in weight status among interviewees. It transpired that most of the optimistic assessors were of normal weight, while most of the realistic assessors were overweight. This made us widen the analytic focus on weight, and it became clear that weight status was not the only issue of importance. Rather, realistic assessors, who were not overweight, were concerned about their weight, either because of previous experiences with gaining and losing weight or due to a present focus on not gaining weight. These weight concerns were not found among optimistic assessors, disregarding their current weight status. For this reason, we believe that our conclusions would most likely remain unchanged, if weight status had been adopted as a recruitment criterion such that a more equal distribution of weight status between the two sub-groups had been achieved. Nevertheless, it cannot be excluded that the unequal distribution of weight status within the two sub-groups may have affected our results, and our findings should therefore be evaluated in this light.

In order to draw more solid conclusions in regard to the dominant role of weight status and weight concerns in self-assessments of dietary health, we suggest that future research should include interviewees' weight status as a recruitment criterion. With specific regard to our findings that both nutritional knowledge and considerations about healthy eating practices appear to be of limited importance in self-assessments of unhealthy diets and do not constitute distinguishing features of 'optimistic' or 'realistic' assessments, it would be fruitful if these findings were further explored in quantitative studies. Further, the present study did not explore considerations underlying the self-assessment of diets that to a greater extent comply with dietary guidelines. Doing so might yield more perspectives on the considerations underlying lay people's self-assessments of dietary health than this study was able to reveal.

5. Conclusions

When interviewees with unhealthy diets were asked to assess the healthiness of their diets, they evaluated healthiness on the basis of their nutritional knowledge and considerations about healthy eating practices, but these considerations were overruled by more decisive criteria. Thus, diets could be assessed as being not exactly healthy, but nevertheless as being healthy enough – so long as interviewees were feeling good. Furthermore, their history of weight status and weight concerns proved to be decisive elements in self-assessments. Those who had experienced problems in these areas tended to be realistic about their unhealthy diets, while optimistic assessments of unhealthy diets were expressed by those who did not perceive themselves as being overweight, had not had past experiences of weight loss or weight gain or were not concerned about their weight. This study indicates that decisive criteria in lay people's self-assessments of unhealthy diets differ markedly on these points from the criteria employed in FBDG. It is suggested therefore that efforts to promote dietary health among people who have unhealthy eating habits must acknowledge these differences and take them into account in developing strategies.

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